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Wright-Patterson Air Force Base, Ohio

THE INFLUENCE OF ROLES ON THE
DECISION-MAKING BEHAVIOR OF AIR FORCE
COMMUNICATIONS SERVICE MIDDLE MANAGERS

THESIS

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THE INFLUENCE OF ROLES ON THE DECISION-MAKING BEHAVIOR OF AIR FORCE COMMUNICATIONS SERVICE MIDDLE MANAGERS

9 Master's THESIS,

Presented to the Faculty of the School of Engineering

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in Partial Fulfillment of the

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by

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PREFACE

This study would not have been possible without the support received from many senior executives and project officers at several Air Force Communications Service agencies. I wish to thank Colonel J. D. Caldwell, AFCS Assistant Deputy Chief of Staff/Personnel, and Mr. Thomas Yium of the AFCS Office of Operations Research and Analysis.

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Finally, I wish to express my appreciation to my wife, Denise, for her much-needed encouragement and for typing this report.

Captain Jacob P. Miller

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ABSTRACT

The policy-capturing technique was used to capture the decision-making behavior of 500 Air Force Communications Service middle managers assigned to headquarters AFCS, Northern Communications Area, Strategic Air Command Communications Area, and Tactical Communications Area. Eleven pieces of demographic information were collected which were assumed to represent a variety of possible role behaviors. The AID algorithm, regression analysis, and contingency tables were used to determine the extent to which organizational goals and role-groups influence the decision-making behavior of the managers. The results of the study indicate that several role-groups are active within the population. However, in a practical sense, the role-groups have little effect on decision-making, thus implying that the organizational goals have more effect than do the role-groups.

THE INFLUENCE OF ROLES

ON THE DECISION-MAKING BEHAVIOR OF

AIR FORCE COMMUNICATIONS SERVICE MIDDLE MANAGERS

I. INTRODUCTION

Introduction

An individual occupies many roles as a member of society such as citizen, parent, church member, worker, or club member. In an organization, an individual can also occupy a variety of roles such as a manager, an officer in the Air Force, a squadron maintenance officer, and a previous Strategic Air Command pilot. Each of these roles has socially defined rights, duties, and obligations. In addition, the organization places demands on the individual which at times can come into conflict with the various role prescriptions.

This research effort is an attempt to identify role groups and their influence on the decision-making behavior of middle managers using policy-capturing techniques. The data base for this study was collected jointly with Lieutenant Colonel Carl G. O'Berry (1977). His study, also sponsored by Air Force Communications Service, focused on the determination of the presence of goal congruence between organizational levels within Communications Service.

Decision-Making and Role Behavior

An investigation of the decision-making behavior of a manager can lead to insights into the priorities of that manager and the influences on his decision-making. The

decision-making process can be divided into several stages which have been represented in a variety of ways. One such representation suggests that a manager 1) defines the problem, 2) develops decision criteria, 3) generates alternatives, 4) assesses the potential outcomes, 5) makes the decision, and 6) implements the decision (Bobbit, et al., 1974:294). This decision-making process is affected by the nature of the problem, the organizational context, the personality characteristics of the manager, and by basic human limitations (Katz and Kahn, 1966:274). The primary focus of this research is on the factors affecting decision-making which are mostly psychological in nature. For example, every person occupies a particular position within an organizational space, and that position will affect his knowledge, experiences, attitudes, and judgements. In addition, people tend to be influenced by outside reference groups. These groups are usually at their same level of power and status, or slightly above it (Katz and Kahn, 1966:284,285). These influences on the decision-making behavior of the individual are known as role expectations (Chapter II). The role expectations constitute the expected performance, behavior, and attitudes of a particular organizational position. These expectations originate from many sources, which fall into two major groups: the formal organization and the informal work groups. Scott and Mitchell (1976) summarize these influences:

> The individual is influenced in actions by two major sources of role expectations--the formal demands made by the organization, and the informal ones made by the groups contacted by the

> individual in the work situation. Thus both formal and informal expectation forces make behavioral demands on the individual (p. 254).

This statement can be represented visually as in Figure 1.

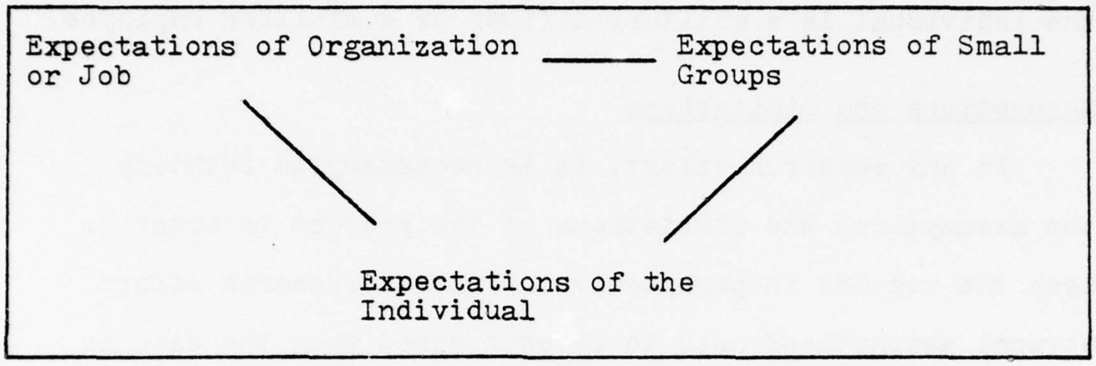

Figure 1. Role Expectations and Their Interactions (Scott and Mitchell, 1976:255)

Research Objectives

The above quotation proposes that the individual is influenced in his behavior by both the demands of the organization and the informal work groups. The objective of this research project is to analyze the influences of roles on the decision-making behavior of middle managers assigned to Air Force Communications Service. More specifically, this study will attempt to answer the following questions:

1. To what extent is a middle manager's decision-making affected by the expectations of the organization (goals)?

2. To what extent is a middle manager's decision-making affected by the expectations of the smaller groups of which he is a member (roles)?

The roles used in this project will be defined by the following demographic information: grade, organizational level, type of work (office symbol), time assigned to the present organization, resident Professional Military

Education history, attendance at Communications-Electronics Staff School, previous major command, previous unit of assignment, education field, education level, and whether the individual is a military officer or a civilian employee.

<u>Assumptions and Limitations</u>

In any research effort, it is necessary to identify the assumptions and limitations of the project in order to keep the results in perspective. In this research effort, several assumptions need to be considered when the data is analyzed. First of all, it is assumed that the sample of people chosen for this study is comprised of people who are knowledgeable of the type of decision requested in the study and that these people represent the middle management of Air Force Communications Service. As is explained in Chapter III, the decision exercise consists of 16 hypothetical Type I Communications Squadrons, each rated by the respondents on the basis of four performance criteria. It is assumed that for the purposes of this study, these simple, contrived examples in the exercise will adequately represent the compass of decision situations encountered by middle managers. It is also assumed that the demographic information which has been collected will adequately identify the various roles which influence decision-making behavior. Finally, it is assumed that each respondent completed the exercise honestly and exhibited his true decision-making behavior.

In addition to these assumptions, it should be noted

that this study is limited in its scope for the following reasons. The most important limitation is that due to time constraints, it was not possible to observe the actual role behavior of each individual. This would have been helpful in identifying the various members of the individual's role set. Also due to time constraints, it was not possible to sample all of the units within Air Force Communications Service.

II. ROLE CONCEPT

The concept of roles is relatively new to both sociology and organizational behavior. The purpose of this chapter is to present a brief discussion of role behavior as it applies to the organizational setting. This discussion will focus on the definitions of role and status and the difference between the concept of role and that of status. In addition, role determinants and the role definition process will be described. Finally, the problems of role integration and role conflict will be briefly discussed.

Role and Status

The concepts of organizational role and status were first incorporated into social theory by Ralph Linton (1936). He proposed that both status and role are fundamental to the analysis of social structure. By status, Linton meant a position in a social system occupied by designated individuals. Role, then, is the behavioral enacting of the expectations attributed to that position. Linton also stated that for each status, there is an associated, distinctive role (Merton, 1957:368). Other sociologists (Merton, 1957; Katz and Kahn, 1966) have expanded on the role concept as described by Linton. These writers indicate that instead of a single associated role for a given status, there is a complement of role relationships which persons have by virtue of occupying a particular status. This is known as a role set (Merton, 1957:369). In addition to the role set,

an individual also has a status set. This complement of statuses which a person occupies, along with the role set for each status, refers to the social structure at a particular period in time. Sequences of role-sets and status-sets can be used to describe social structure over time (Merton, 1957:370).

In the organizational context, an individual's relation to the organizational structure and ongoing interactions within the organization can be identified by that individual's status or office. Associated with each office is a set of expected behaviors, or his role-set (Katz and Kahn, 1966: 173). As an example, an individual's status or office within the organization may be a squadron maintenance officer. His role-set would be comprised of other squadron maintenance officers he works with, his subordinates, superiors, other officers of his rank, and others. Each member of the role-set attempts to induce a particular behavior in the individual holding a particular status. For some members of the role-set, the role relationship which is defined is of primary concern, while for others it may be only peripheral (Merton, 1957:371). For example, the chief of maintenance may have more interest in the behavior of the squadron maintenance officers than do all the other officers in the Air Force.

Role Definition

The process of role definition is a series of interactions between the members of the role-set and the

individual or focal person. Katz and Kahn (1966:175-187) describe each interaction in the role definition process as a role episode. Each role episode is based on four concepts--role expectations, the sent role, the received role, and the role behavior (See Figure 2).

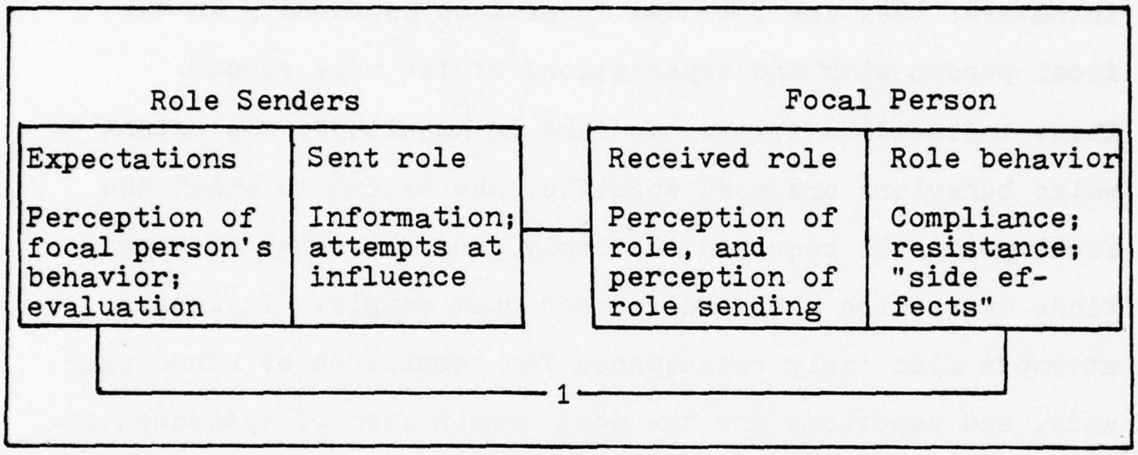

Figure 2. A Model of the Role Episode
(Katz and Kahn, 1966:181)

The first half of Figure 2 is the role sender. Every member of an individual's role-set depends on his performance in one way or another. Since these people depend on the individual's performance, they develop beliefs about what he should and should not do to fulfill his role. These beliefs are known as role expectations. These expectations in aggregate define the individual's role and they may deal with what a person should do, what kind of a person he should be, how he should think or act, and how he should relate to others. The role expectations for a given individual exist in the minds of the members of the role-set. These are standards for judging performance. The members of the role-set observe

the individual and evaluate his performance in relation to their expectations. When the focal person deviates from the expected behavior, the members of the role-set will communicate their expectations to the focal person.

The acts of role sending are not merely informational in nature; they are intended to produce conformity in the focal person with the expectations of the role sender. These influence attempts can vary in magnitude, the extent to which behaviors are made specific, the extent to which the focal person is required to comply, and the range of conditions over which the focal person must comply. Influence attempts also imply consequence for compliance or noncompliance, and sanctions are the most common form of consequences. The role sender may arrange either gratifications or deprivations for the focal person. The availability and visibility of sanctions, whether or not they are used or even threatened, is the major basis for gaining compliance with the requirements of the formal organization.

The second half of Figure 2 is the focal person. The focal person receives the role message and then reacts to the sent role. The sent role is a portion of the focal person's objective environment and organization. However, each individual responds not to the objective environment but to his perceptions of the objective organization and environment. Therefore, for the focal person, there is not only the sent role but also a received role, which is his perceptions and cognitions of the role that was sent. The

closeness with which the received role corresponds to the sent role is dependent upon the properties of the sender and the focal person, the content of the sent role, the clarity of the message, and the like.

Although the sent role is the way in which the organization communicates the "do's and don't's" associated with each office, it is the received role which influences behavior and motivates action. The behavioral outcomes of a role episode may or may not be as intended by the role sender. For example, if the sent role appears to the focal person to be illegitimate or coercive, strong resistive forces may be aroused in the focal person. In addition to the influence pressures by the members of the role-set, the focal person is also affected by a variety of psychological pressures. Thus, role sendings are only a partial determinant of a person's behavior while on the job.

Although in most organizations role behavior is largely dependent on role sending, several other factors can enter into the process of role definition. The objective properties of the situation, the nature of a task, and previous experience with the task can influence role behavior. In such cases individuals respond to situational cues rather than the role expectations of other individuals. In addition to situational cues, a person may be motivated by internal sources, such as the intrinsic satisfaction of taking on a certain role. In this case, the focal person becomes a role sender by sending expectations to himself.

Finally, role behavior may be influenced by the individual's background and learned responses. The long process of training and socialization, both in an organization and a culture as a whole, places the person in a state of role-readiness. He is prepared, among other things, to accept formal authority and to comply with its requests.

The final portion of a role episode is indicated by Arrow 1 in Figure 2. Arrow 1 indicates a feedback loop. The focal person receives the sent role and modifies his behavior accordingly. This new behavior is perceived and evaluated by the role sender, thus initiating another role episode. Thus, in an organization, the definition of role behavior is a series of continuous cycles of sending, receiving, responding, evaluating, and sending by the persons in many overlapping role-sets.

Katz and Kahn (1966:183) point out that this description of the process of role definition is an oversimplification of the complex interactions in an organization. Katz and Kahn (1966:187-197) propose an expanded model to include such contextual factors as the organizational context, personal attributes, and interpersonal relations in the model. This expanded model is shown in Figure 3.

The attributes of the person reflect the individual's motives, values, defense preferences, sensitivities, and fears. These factors can affect the role episode in a variety of ways. First, some traits can facilitate or hinder the communication between the role sender and focal

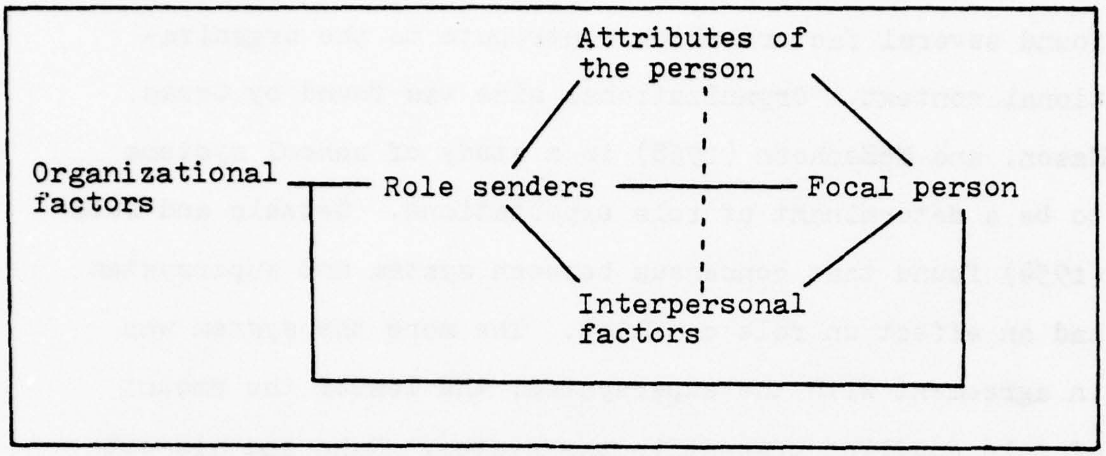

Figure 3. A Theoretical Model of Factors Involved in the Taking of Organizational Roles (Katz and Kahn, 1966:187)

person. Second, different people will perceive the same sent role in different ways. Finally, the role behavior will eventually have an effect on the personality of the focal person. In other words, we become what we do. The interpersonal relations factors can affect the role episode in ways similar to that of personal attitudes. The quality of relation which exists between the members of the role-set and the focal person can affect the received role. In addition, the role behavior will eventually have an effect on the interpersonal relations.

With respect to the organizational factors, Katz and Kahn (1966) state:

> To a considerable extent the role expectations held by members of the role set--the prescriptions and proscriptions associated with a particular office--are determined by the broader organizational context (p. 187).

Reviewing the research on organizational factors as determinants of role expectations, Katz and Kahn (1966:191-193)

found several factors which contribute to the organizational context. Organizational size was found by Gross, Mason, and McEachern (1958) in a study of school systems to be a determinant of role expectations. Getzels and Guba (1954) found that consensus between system and supersystem had an effect on role conflict. The more the system was in agreement with the supersystem, the lesser the amount of role conflict present in the system. Kahn and his colleagues (1964) identified several normative expectations which appeared to be characteristic of the organization as a system. In addition, position in the organization, the objective content of the role activity, and hierarchical position in the organization have been found to have an impact on role expectations. In summary of this research, Katz and Kahn (1966) state "that the characteristics of the organization as a whole...act to determine the expectations which role senders hold and communicate to the occupant of a particular job" (p. 193).

While Katz and Kahn state that the characteristics of the organization affect the role sender, Scott and Mitchell (1976) present a slightly different model. As shown in Figure 4, the organization, the individual, and the members of the role-set all have expectations. All three of these sets of expectations interact with each other (p. 255). The organizational expectations can be thought of as the individual's position in the chain of command, the responsibility and authority associated with that position, and

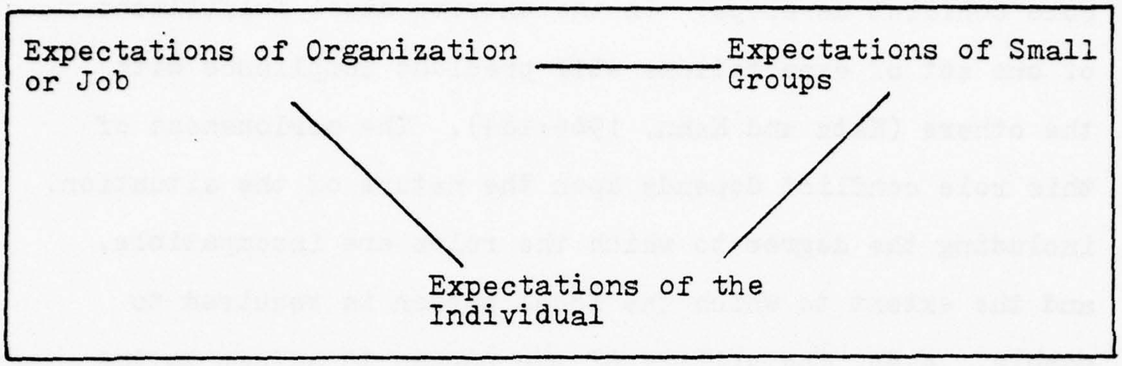

Figure 4. Role Expectations and Their Interactions (Scott and Mitchell, 1976:255).

his specific functions and duties.

The members of the role-set may represent formal or informal groups, and the role expectations of these groups may or may not be congruent with those of the organization. The individual has his own expectations of his role in both the formal organization and the informal groups. His expectations will be influenced by his background, social class, attitudes, and values (Gibons, et al., 1973:273). The result of the interaction of these role expectations is a process of fusion. The variety of expectations placed upon an individual are integrated into a rational role-set (Scott and Mitchell, 1976:255).

Role Conflict and Role Integration

The individual in the organization is continually being faced with multiple expectations from a variety of sources. When the expectations of two or more of these sources are contradictory, that is, the fulfillment of one expectation makes it more difficult to fulfill another,

role conflict develops. In the extreme case, fulfillment of one set of expectations will preclude compliance with the others (Katz and Kahn, 1966:184). The seriousness of this role conflict depends upon the nature of the situation, including the degree to which the roles are incompatible, and the extent to which the focal person is required to comply. Also, the ability of the person to adjust to the situation will affect the seriousness of the role conflict (Scott and Mitchell, 1976:257).

Several types of role conflict can be identified. Generally speaking, role conflict can exist between organizational functions and between the expectations of the organization and the expectations of the various groups which make up the individual's role-set (Scott and Mitchell, 1976:258). More specifically, role conflict types include intrasender, intrarole, interrole, and person-role conflict. Intrasender conflict indicates that the expectations of one member of the role-set are not compatible (Katz and Kahn, 1966:184). Intrarole conflict is the result of the multiple expectations placed on a particular office or status. The multiple statuses which a person may occupy could result in conflicting expectations known as interrole conflict. Finally, person-role conflict is the result of the basic values, needs, and attitudes of the individual being violated by the role expectations for his particular office (Gibons, et al., 1973:274,275). The results of role conflict will cause an individual to act with indecision, emotional strain,

emotional stress, or other manifestations of psychological stress (Gibons, et al., 1973:275).

The minimization of role conflict and the integration of role expectations is important to maintaining the integrity of the individual and the organization (Scott and Mitchell, 1976:255). Both the organization and the individual play important parts in the role integration process. On the side of the organization, management can help in the role integration process by increasing communication, anticipating and modifying the role perceptions of the individuals, and by building consensus within the organization (Scott and Mitchell, 1976:258). Incongruence of organizational goals can result in both intrasender and intrarole conflicts (Gibons, et al., 1973:275).

In addition to the organization, the individual has several mechanisms to assist him in the role integration process. First, the individual is able to differentiate between the intensity of two role expectations. That is, one member of the role-set may not have as much interest in influencing a focal person as another member might have. Next, the focal person can determine which member of his role-set has the most power to influence him. In addition, in most situations the focal person has only intermittent contact with each member of his role-set, thus temporarily eliminating some of the expectations placed on him. Sometimes the state of conflicting role requirements comes to the attention of the role senders. In this case, conflict

emerges between the role senders and the focal person is relieved of the problem. Also, since many people who occupy similar statuses have similar conflicts, the individual can share his problems with others, thus relieving some anxiety. Finally, if all else fails and if the individual's status will not be damaged, he may break off relations with one of the conflict-causing role-set members (Merton, 1957:371-379).

Summary

The individual in an organization usually occupies one position (status or office) in that organization. The people with whom he interacts and works (role-set) and the organization have expectations about his performance. These role expectations prescribe and proscribe the attitudes, beliefs, and behaviors which are appropriate to the particular status. The members of the role set and the organization communicate the role expectations to the individual, and the way in which the individual responds depends upon a variety of factors.

Since the individual is constantly receiving multiple role expectations, it is important to the individual and the organization that he integrate these expectations into a rational role definition. Both the organization and the individual have mechanisms to facilitate this integration process. Unless the integration is reasonably effective, role conflict, which impacts upon the functioning of the individual and the organization, will result.

III. RESEARCH METHODOLOGY

The purpose of this chapter is to describe the methods used to collect and analyze the data associated with this research effort. The first portion of this chapter presents some general background information on policy-capturing techniques and the AID algorithm. The remainder of the chapter outlines the procedures used in this research effort to gather and analyze the data.

Policy-Capturing

Judgement and decision-making are fundamental cognitive activities which affect us all. As society becomes more complex and technologically-oriented, modern man has been placed in a position where some decisions can affect large groups of people. For years the emphasis has been placed on providing the decision maker with more and more information upon which to make his decisions. The decision process itself has received very little attention and has been classed with things that cannot be learned, such as intuition (Slovic and Lichtenstein, 1971:652). However, in recent years this attitude has changed. The study of the decision process began shortly after World War II with the study of clinical judgement in the field of psychology. This early work by such people as Kelly and Fisk (1951), Holtzman and Sells (1954), and others focused on the accuracy of the decision maker. These studies found typically that clinical judgements tend to be unreliable, unrelated to the experience

of the judge, unaffected by the amount of information supplied to the judge, and rather low validity on an absolute basis (Goldberg, 1968:485). Because of the results of these early studies, more recent studies have focused on the decision process in terms of how the decision maker utilizes the information available to him. This has become known as policy-capturing.

The purpose of policy-capturing is to study the manner in which a decision maker combines and weights cues in making a decision (Hoffman, et al., 1968:338). Some of the first work in this area was done by Paul J. Hoffman (1960). Hoffman presented three possible ways to study the mental process. The mental process could be described by inference through subjective experience, by direct observation through electro- and neurophysiological observation, and by mathematical models (p. 117). In using mathematical models, a search is conducted for a model which uses as its inputs the information which is presented to the decision maker, and combines the data in some optimal manner, so as to reproduce an accurate copy of the responses of the decision maker (Goldberg, 1968:485). Hoffman compares this model to the chemical formula of minerals. The judgement model can explain what is observed concerning certain characteristics of a decision maker and can be used to predict future decisions. However, it is not known how completely the underlying decision process has been represented, so Hoffman refers to the judgement model as a "paramorphic representation"

(Hoffman, 1960:125). The primary restriction is that the information available to the decision maker must be placed in a controlled setting so that all decision makers in a study have the same known information available to them. This restriction makes it possible to describe the method used by the decision maker to combine and weight the information because the input variables are known (i.e., the information available) (Hoffman, 1960:118).

In a typical policy-capturing exercise, the information is presented to the decision maker in the following way: the information available is reduced to a set of variables, the information is expressed in numbers or categorical responses, and each variable is at least ordinal in scale. This results in a set of numbers or classifications for each case upon which a decision is to be made which represent the degree to which certain characteristics are present (Hoffman, 1960:119). This format usually raises objections because it is contrived, appears unrealistic, and does not present "enough" information to the decision makers. Recently, however, studies have been done to assess the validity of this format. In a study conducted by T. R. Brown, policy equations generated by decisions made under natural and contrived situations were compared. The major finding of the study was that the models obtained under the contrived situations agreed closely with the models produced under natural conditions (Brown, 1972).

The policy-capturing technique has been used to model

the judgements of decision makers from a variety of fields. Hoffman, Slovic, and Rorer (1968) used policy-capturing to study the cue utilization of radiologists. Paul Slovic (1972) used the technique to study stock market investment decisions. In another study, the internal control judgements of auditors was modeled by Robert Ashton (1974). Finally, L. L. Gooch (1974) used the policy-capturing technique to study loan-making decisions of bank loan officers. These are but a few examples of applications of the policy-capturing technique.

The AID Algorithm

The Automatic Interaction Detector (AID) algorithm was originally developed by John A. Sonquist and James N. Morgan (1964) for use in analyzing large amounts of sociological survey data. Traditional analysis techniques such as regression analysis are hampered by such problems as large sample sizes, many predictors which are classifications, nonlinear relationships, interaction effects between predictors, and correlations between classifications (Sonquist, 1970:5). The primary purpose of AID is to assist in "determining which of the variables, for which data have been collected, are related to the phenomenon in question, under what conditions, and through what intervening process, with appropriate controls for spuriousness" (Sonquist and Morgan, 1964:2). In addition, the assumptions of additivity and linearity are not required (Sonquist and Morgan, 1964:1).

The basic algorithm has been modified by James Koplyay at the Air Force Human Resources Laboratory (AFHRL) to

include options for random sampling of the data, cross validation, additional statistics for the splits, and an option to plot the output of the AID program in the form of a decision tree (Koplyay, 1973:8). Further modifications of the AID4 program were made by Lawrence Gooch of the University of Texas. He adapted AID4 for use on the CDC 6600 computer and titled it AID4UT (Gooch, 1974).

Theory. Basically, the AID algorithm uses the iterative application of the one-way Analysis of Variance (ANOVA) to sequentially divide the total population into the set of mutually exclusive groups which best explains the variance in the criterion variable (Gooch, 1976:762). The algorithm computes a grand mean for the population and the total sum-of-squares (TSS) or the total squared variance from that grand mean. Then the algorithm divides the population into K predictor groups and performs K-1 one-way ANOVA calculations. The means for each group are calculated along with the squared variance between combinations of two groups (BSS) and the squared variance from the mean within each group (WSS). Using the model TSS = BSS + WSS, the algorithm chooses the combination of groups which maximize BSS and minimize WSS, since TSS is constant for the population. The algorithm continues attempting to split each subgroup into two more groups until all of the variance is explained or other stopping criteria are met (Sonquist and Morgan, 1964: 6). The total amount of variance explained by the AID splits can be calculated from BSS/TSS.

The output of the AID algorithm can be presented in graphical form called an AID-TREE. This is a visual presentation of the decision process. The most important predictors that contribute the most to the reduction in the unexplained variance are represented at each branching of the tree (Gooch, 1976:762). Since the AID-TREE is a visual representation, it is the easiest place to start in interpreting the results of the AID algorithm. The AID-TREE can take one of two forms: trunk-twig or trunk-branch.

The trunk-twig is a main branch from which small groups split off. They may either terminate on top, on the bottom, or alternate around the trunk. The trunk-branch structure is represented by each group being split into subgroups.

Another property of the tree is symmetry or nonsymmetry in terms of the extent to which the same variables are used in the splits. Symmetry implies additivity whereas nonsymmetry implies interaction between the variables which showed up on only one side of the tree and the variables used in preceding splits.

In addition to the shape of the AID-TREE, the type of final group is indicative of the structure of the decision process. A "small" group is one which is too small to be split further. An "explained" group is large enough in size, but the WSS is too small for a split to be attempted. Finally, an "unexplained" group is large enough but there is no variable available which can explain any more variance within the group (Sonquist and Morgan, 1964:110-113).

The analysis of the AID-TREE is generally heuristic in nature. For further information, see Sonquist and Morgan, 1964; Sonquist, 1970; Sonquist, Baker, and Morgan, 1973; Gooch, 1974; and Gooch, 1976.

Applications. The AID algorithm has been used by several researchers in the analysis of decision policy. L. L. Gooch (1974) used AID in the study of loan officers' decision policy. The United States Air Force Academy has used AID to examine cadet rating policy, and Artz used AID to examine the rating policies of evaluators of AFROTC detachments (Artz, 1974).

The Population

Middle management can be thought of as those people who are primary operative managers or those who are project managers, that is, those who plan, organize, and control a project or other activity. Middle managers at Air Force Communications Service (AFCS) were defined as people in military pay grades O-1 through O-5 and civilian pay grades GS-9 through GS-13. It is these people at all organizational levels who plan, organize, and control specific projects.

The organizational levels within the Air Force Communications Service are divided into the headquarters, six areas, and the numerous units within each area. We decided to choose as the population to be sampled the personnel assigned to Air Force Communications Service (AFCS) headquarters, Northern Communications Area (NCA), Strategic Air Command Communications Area (SACCA), the Tactical Communications Area (TCA),

and the units within each of the three areas. In order to keep the size of the project within reasonable limits, only three areas were selected to be sampled. Northern Communications Area was selected as a representative of the general communications mission. Tactical Communications Area was selected because it has the specialized mission of serving Tactical Air Command. Strategic Air Command Communications Area has the specialized mission of serving the Strategic Air Command and is a relatively new AFCS unit.

In order to further limit the scope of the project, approximately 80 persons were selected for participation in the exercise at each organizational level. From lists of personnel assigned to the various units supplied to us by headquarters AFCS, a total of about 670 personnel were selected at random to participate in the exercise. The exercise booklets were distributed during April, 1977 through base distribution systems at the headquarters and the area headquarters, and the booklets were distributed by mail to the personnel assigned to the units. All exercises were returned by mail to the author. The total number of personnel who returned the completed exercise was 513, which is 77.3 percent of the population sampled. The breakdown of the distribution of the exercise and the response rate is shown in Table I.

<u>The</u> <u>Instrument</u>

The design of the instrument for this study was modeled after a similar instrument used by Lieutenant Colonel

Table I
Distribution of Exercises and Response Rate

Group	Number of Exercises Distributed	Number of Useable Returns	Response Rate
Hq AFCS	80	70	87.5%
Hq NCA	80	62	77.5%
Hq SACCA	80	69	86.3%
Hq TCA	63	58	92.0%
Squadrons	360	254	70.6%
TOTAL	663	513	77.3%

Harrell (1975) for his Doctoral dissertation. The instrument is a full factoral design with four orthogonal decision criteria and an eight-point rating scale (Appendix A contains a copy of the instrument).

The first part of the instrument contains eleven questions designed to gather demographic information. In addition, the respondent is given an opportunity to request an analysis of his decision-making pattern by indicating so and writing his name in the booklet.

In the second part of the exercise, the respondent is asked to rate hypothetical Type I communications squadrons on a scale of highly unsatisfactory to highly satisfactory (eight points) on the basis of four performance criteria (See Figure 5 for an example).

The four performance criteria were selected with the assistance of the Operations Research Analysis Office at headquarters AFCS. The criteria were selected on the basis

Performance Evaluation of Squadron Number 4

S=Satisfactory U=Unsatisfactory

1. Personnel programs in this squadron are rated. . . . U

2. The quality of service provided by this squadron is rated . . . . S

3. Compliance with AF/AFCS/Area directives in this squadron is rated as . . . . S

4. The quality of maintenance in this squadron is considered to be . . . . U

The overall performance of this AFCS squadron should be evaluated as:

Highly Unsatisfactory		Unsatisfactory		Satisfactory		Highly Satisfactory	

Figure 5. Evaluation Task Example

of being realistic and independent, and that they represent valid indicators which relate to the decision-making policies associated with AFCS. The four performance criteria were described in the booklet as follows:

1. Personnel Programs. Indicates the success of the unit in terms of moral and welfare programs, disciplinary rate, IG complaint rate, retention rate, etc.

2. Quality of Service. Indicates unit success in factors related to the service provided to the customer. Includes such factors as speed of service, message handling time, operator courtesy, accuracy, air traffic control quality, and responsiveness to new customer requirements.

3. Compliance. Indicates how closely the unit being rated follows Air Force, AFCS, and Area directives, as determined by IG reports, Air Traffic Control Analysis reports, and staff visit reports.

4. Maintenance Quality. Indicates maintenance effectiveness and efficiency as reflected by maintenance analysis reports, operational ready rates, uptime rates, etc.

Each of these performance criteria was indicated as being either satisfactory or unsatisfactory. Sixteen combinations of the four performance criteria, graded satisfactory or unsatisfactory, are possible. These sixteen combinations were presented in the booklet in a random order as 16 hypothetical Type I communications squadrons as shown in Appendix A and Figure 5. The respondent was asked to consider each of the criteria independent of one another and to then rate each squadron on an eight-point scale from highly unsatisfactory to highly satisfactory.

Upon receipt of the exercise booklets, the author

transcribed the responses onto computer cards using the codes and order of the responses as they appear in the exercise booklet. The respondent's name was placed at the end of the field if he requested an analysis of his decisions. The evaluation rating was coded one to eight with highly unsatisfactory equal to one.

Data Analysis Procedure

The analysis of the data was accomplished using four separate stages. First, the raw data was transformed and stored on a disk file so that the information would be compatible with the computer programs to be used. Next, regression analysis was used to calculate individual relative weights. The AID algorithm was used to identify important demographic variables and fourth, the SPSS subprograms FREQUENCIES and CROSSTABS (Nie, et al., 1975) were used to generate frequency distributions and contingency tables. Each of these steps will be explained in greater detail below.

Data Transformation. Several transformations were done to the raw data base to facilitate computer analysis. For the regression analysis, the raw data was expanded from one case to a record card to 16 cards per case. One decision was recorded on each card. In addition, since AID will accept only integer values, the responses to the demographic questions which were alphabetics were transformed to integer values using the convention of A=1, B=2, C=3, etc.

Each respondent was asked to indicate his office symbol

and the year and month he was assigned to his present organization. The office symbols were grouped into eight categories and assigned a code number, thus creating a new variable, office code. Table II shows the groupings of the office symbols. From the information provided, the number of months each respondent had been assigned to his organization (as of June 1977) was calculated using the formula:

$$\text{months} = (77 - \text{year assigned}) \times 12 + (6 - \text{month assigned})$$

The months assigned were then grouped into 6 categories and assigned a code as shown in Table III.

Table II
Office Codes

Symbol	Category	Code
CC, CE, CD, CS	Command	1
LG, NC	Logistics	2
XR, PR, XO, XP	Plans	3
IG, II	Inspector General	4
DO, BC, MB	Operations	5
EP, DE, SD	Engineering	6
FF, FM, FP	Air Traffic Control	7
LO, AD, OI, AS, JA, HO, SE, SP, AC, DA, DP	Other	8

<u>Regression Analysis</u>. The next step of the data analysis was to determine the relative weights each respondent put on each of the four performance criteria. The method of least squares (Freund, 1971:363) was used to calculate the

Table III
Months Assigned

Number of Months	Code
0-6	1
7-12	2
13-36	3
37-60	4
61-120	5
120+	6

regression coefficients for each of the criteria. The relative weight (RWT) for each of the performance criteria was calculated using the procedure suggested by Hoffman (1960: 120,121).

$$RWT = \frac{\beta_{oi} r_{oi}}{R^2}$$

where

β_{oi} = the regression coefficient for the i^{th} predictor

r_{oi} = the validity coefficient (correlation with judgement)

R^2 = the squared multiple correlation coefficient

In this application, the validity coefficient is equal to the regression coefficient.

The relative weights calculated for each of the four performance criteria sum to 1. Since the AID algorithm will accept only integer values, each of the relative weights was multiplied by 1000 to produce integer values with a range of zero to 1000. The relative weight can be

used to describe the relative contribution of each of the criteria as a portion of the predictable linear variance (Hoffman, Slovic, and Rorer, 1974:340). Table IV is a summary of the information collected and used in the data analysis.

AID Analysis. Five separate AID runs were made. For the first AID run, all of the collected data, and the computed data was used in the analysis as independent variables. The dependent variable was the evaluation indicated in each decision. For the remainder of the runs, the months assigned, the office code, and all of the collected data, except evaluation, were used as independent variables. For each of the four runs, the relative weight of one of the four performance criteria was used as the dependent variable. The first AID run was analyzed for the degree to which the demographic variables explained the variance on the decision-making behavior of the respondents. The remaining runs were analyzed to identify the groups of people who placed a high relative weight on each performance criterion and those who placed a low relative weight on that criterion.

The resulting groups were analyzed with respect to their importance. Two criteria were used. First, if a split resulted in only a nominal difference in the average evaluation between the groups, it was considered that the variable used to make the split was not significant. The second criterion used was the amount of variance in the model explained by the split. In statistical analysis this is known as the

Table IV
Data Summary

COLLECTED DATA

Variable	Categories
*Status	Military/Civilian
*Grade	0-1 through 0-5 GS-9 through GS-13
*Organization Level	Hq AFCS, NCA, TCA, SACCA Squadrons
Resident PME	Yes/No
Com-Elect Staff School	Yes/No
*Previous Majcom	HqUSAF, ADCOM, AFCS, MAC, SAC, TAC, USAFSS
Previous Unit Level	Hq, Area/NAF, Group/Sq.
Education Level	no degree, graduate work, Master's, postgraduate work, Doctorate
Education Field	Engineering, Science, Management
Evaluation	1-8

COMPUTED DATA

Variable	Categories
Months Assigned	See Table II
*Office Code	See Table I
Pers. Prog. RWT	0-1000
Service Quality RWT	0-1000
Compliance RWT	0-1000
Maintenance Quality RWT	0-1000

*variables used in CROSSTABS

Coefficient of Determination and is designated by R^2. This is calculated in AID as BSS/TSS. The larger the R^2 value, the more the variance in the model has been explained. In addition, the larger the increase in R^2 from one split to

another, the more significant the predictor variable on which the split was made.

Finally, a T-test on means was done to verify that the high and low groups were significantly different.

Frequencies and Contingency Tables. First, the SPSS program FREQUENCIES was used to generate an informative frequency distribution of the demographic variables for the entire population. Then, the population was divided into four groups on the basis of which of the four performance criteria they gave the highest relative weight. Next, each of these groups were divided into several subgroups based on the criterion which received the next highest relative weight.

The SPSS subprogram CROSSTABS was used to generate contingency tables and frequency counts. The demographic variables which were used in this portion of the analysis are those which appeared to be most important in the AID analysis. The variables (marked with an asterisk in Table IV) are status, grade, organizational level, previous major command, and office code. For each variable, a r by 2 contingency table was constructed. The rows of the table contained the different categories of variable, and of the two columns, one represented the portion of the population which rated a particular performance criterion first and the other column represented the portion which did not. Thus, four sets (one for each criterion) of five contingency tables were constructed.

IV. DATA ANALYSIS RESULTS

The results of the data analysis will be presented in several sections in this chapter. First, the results of the regression analysis will be presented, followed by the results of the AID analysis. Finally, the results of the contingency table analysis will be discussed.

Regression Analysis

The regression analysis was used primarily to derive the relative weights each individual placed on the four performance criteria. Since this is a lengthy list, it will not be presented here. However, the relative weights placed on the four criteria by the population as a whole are shown in Table V.

Table V
Relative Weights Assigned to the Criteria by the Population

Performance Criterion	Relative Weight
Service Quality	.49
Maintenance Quality	.23
Personnel Programs	.14
Compliance	.14

AID Analysis

The first step in the AID analysis was to determine the degree of influence that roles, as represented by the demographic variables, had on the decision-making behavior of the sample population. For this analysis, the rating

given each squadron (the evaluation) was the dependent variable and the four performance criteria, plus the demographic information, were used as independent variables. As expected from the results of the regression analysis, the four performance criteria split out in the order of Service Quality first, and Maintenance Quality second, with Personnel Programs and Compliance trading off for third and fourth place. The AID-TREE was symmetrical, indicating that there was probably little or no interaction between the four performance criteria (See Figure 6). The R^2 value after all of the performance criteria had split out was .778. The program continued to split the population on a variety of demographic variables and produced 16 more splits which increased the R^2 value by only .008 to a final value of .786.

Further AID analysis was done to determine what role-groups tended to rate a particular decision variable high and which role-groups assigned a low relative weight to that decision variable. For each performance criterion, the relative weight assigned to that performance criterion was used as the dependent variable, while the demographic variables were used as the independent variables.

<u>Personnel Programs</u>. The first three levels of the AID-TREE using the relative weight assigned to personnel programs are shown in Figure 7. The first split was on the organizational level to which the person is assigned. This first split was statistically significant, but not very

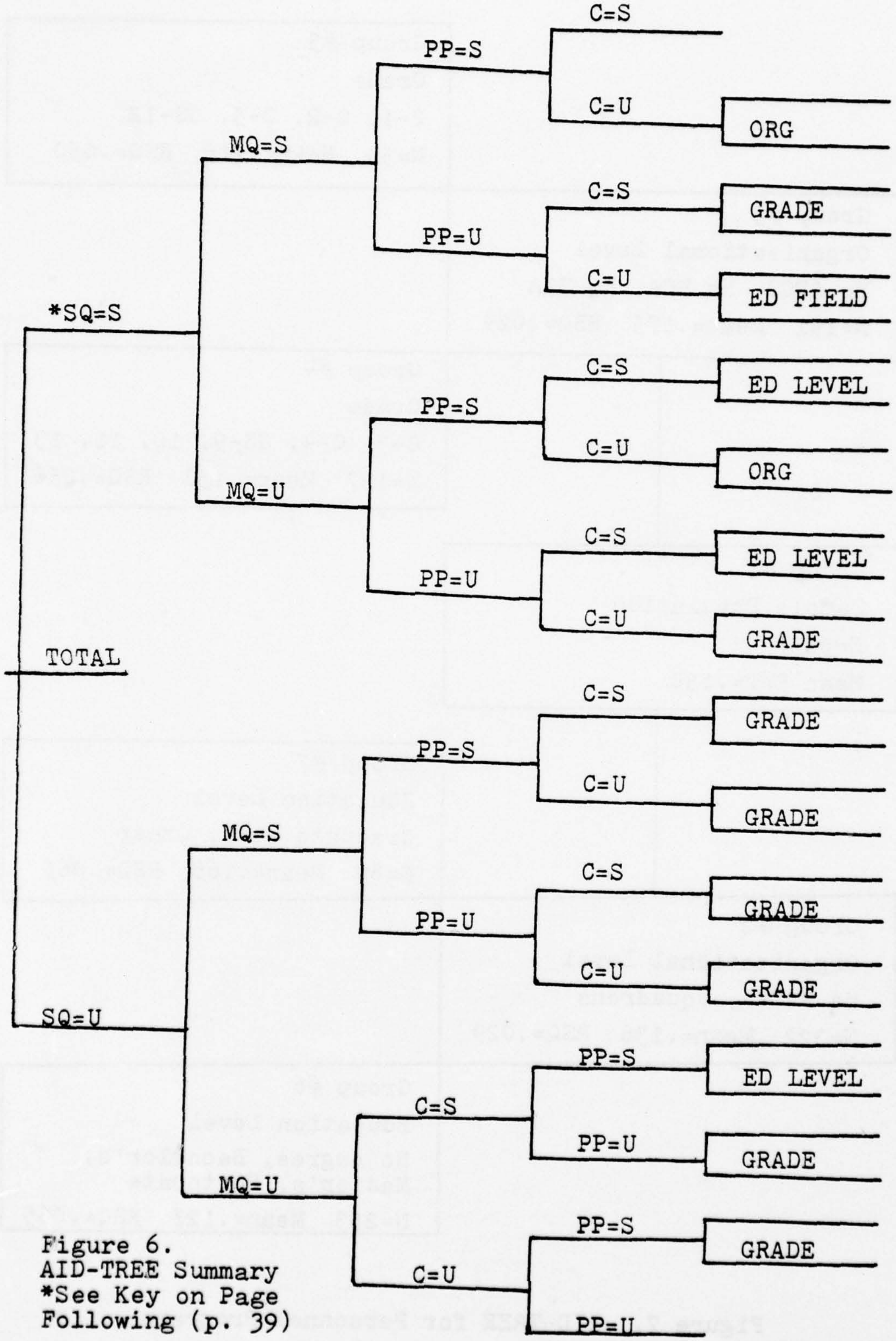

Figure 6.
AID-TREE Summary
*See Key on Page
Following (p. 39)

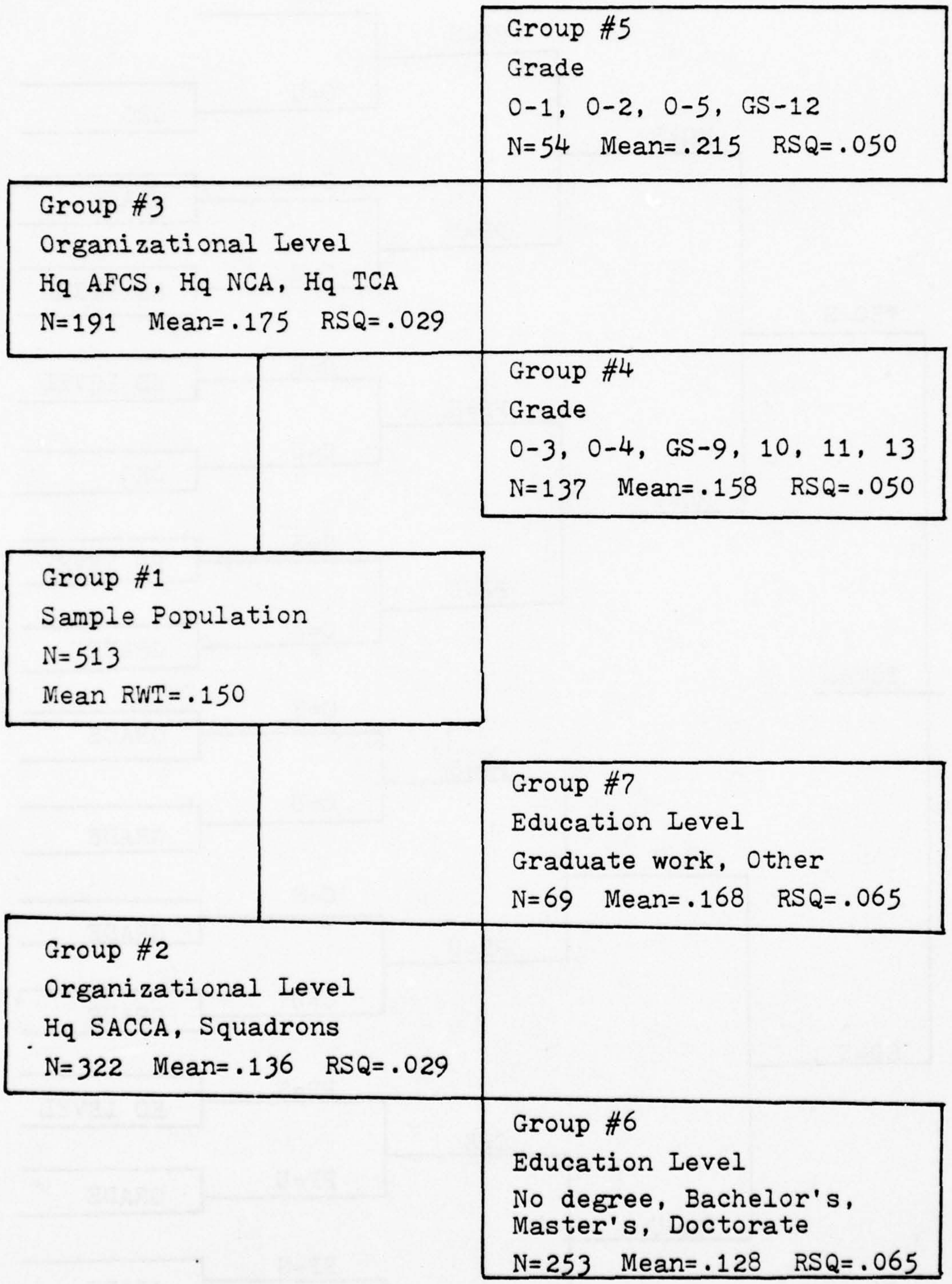

Figure 7. AID-TREE for Personnel Programs

Key for Figure 6

SQ = Service Quality
MQ = Maintenance Quality
PP = Personnel Programs
C = Compliance
S Indicates satisfactory rating of performance criterion
U Indicates unsatisfactory rating of performance criterion

powerful. As is shown in Figure 7, the R^2 value indicates that this split explains only 2.9 percent of the variance in the relative weight assigned to personnel programs. Going to the next level, the high group split on grade while the low group split on educational level. The R^2 value at the end of these splits was only .065.

The group of people which placed a high relative weight on personnel programs (mean = .215) was relatively small and comprised only 10 percent of the population (N=54). This group was composed of Lieutenants, Lieutenant Colonels, and civilians with a GS-12 rating assigned to Headquarters Air Force Communications Service, Headquarters Northern Communications Area, and Headquarters Tactical Communications Area. In contrast to this group, a substantially larger group (N=253) placed a low relative weight on personnel programs (mean = .127). This group includes 49 percent of the population and represents all grades assigned to Headquarters Strategic Air Command Communications Area and to the various squadrons. The hypothesis that the mean

relative weights of the two groups are equal was rejected at the .000 level using Student's _t_-test.

Service Quality. The first three levels of the AID-TREE using the relative weight assigned to service quality as the dependent variable are shown in Figure 8. The first split in this category was made on the variable "grade." The population was split into two approximately equal groups, and the mean relative weight for each group was about the same distance from the mean relative weight for the entire population. The R^2 value was again low for this split, only .048. The next split for the high group was on the previous major command to which the person had been assigned. For the low group, the next split was on the organizational level to which the person is presently assigned. The fraction of variance in the relative weight assigned to service quality which was explained by these variables was only .08. Again the hypothesis that the high and low group have the same mean was rejected by the _t_-test at the .000 level.

The relative weight assigned to service quality by the population as a whole was .49 (Table V). In this AID analysis, the majority of the population was clustered close to that mean. Only two small groups deviated much from the majority of the population. A small group of 28 persons assigned a relative weight to service quality of .571. This group was composed of Captains, Majors, Lieutenant Colonels, and civilians with a GS-10 rating who had been previously assigned to Headquarters USAF, DOD, the Joint Chiefs of

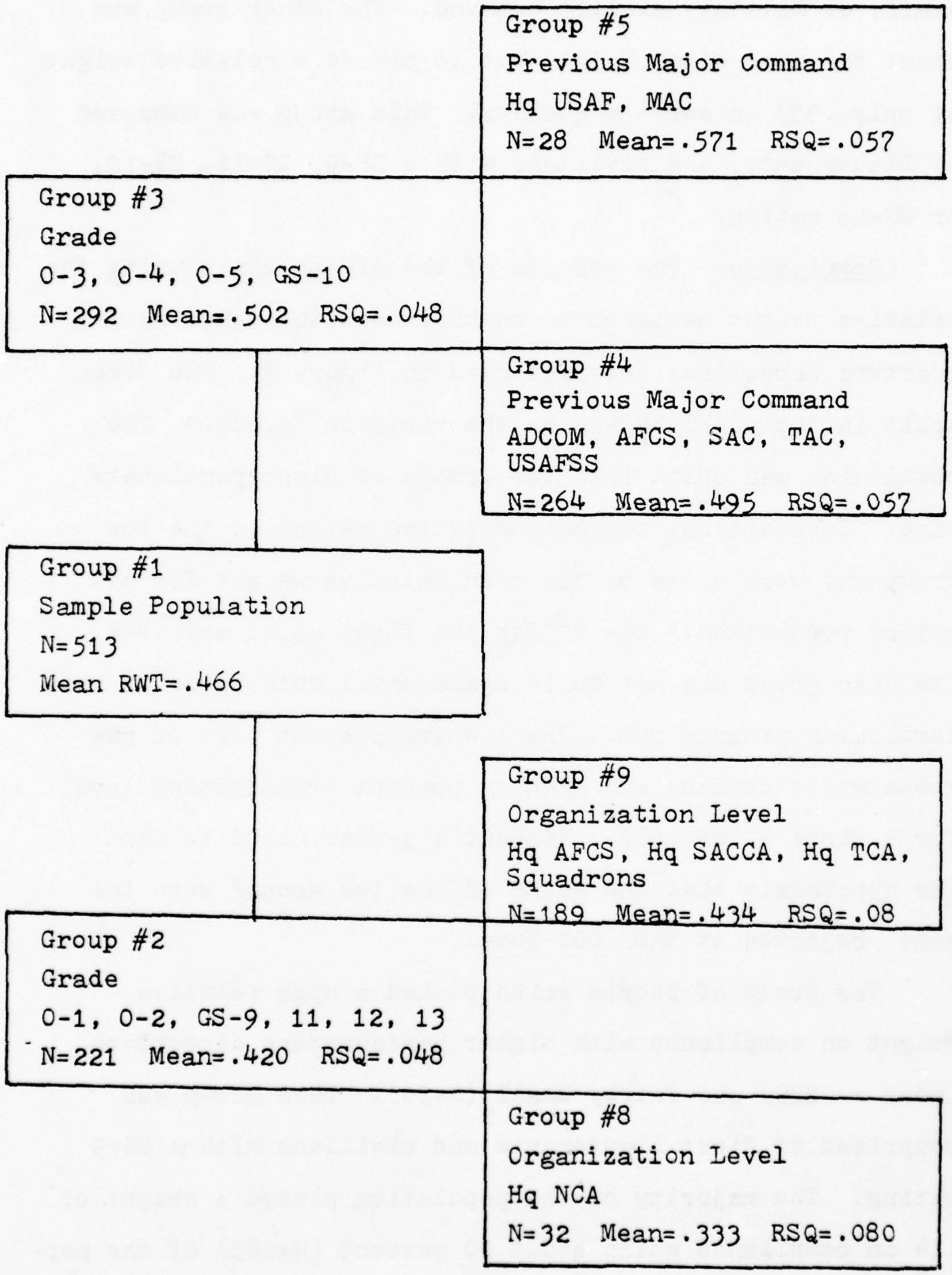

Figure 8. AID-TREE for Service Quality

Staff, or Military Airlift Command. The other group was about the same size (N=32), but it placed a relative weight of only .333 on service quality. This group was composed of Lieutenants, and civilians with a GS-9, GS-11, GS-12, or GS-13 rating.

Compliance. The results of the AID analysis using the relative weight assigned to compliance with higher headquarters directives are presented in Figure 9. The first split in the AID-TREE was on the variable "grade." The population was split into two groups of disproportionate size. In addition, the mean relative weight of the low group was very close to the mean relative weight for the entire population. The R^2 for the first split was .048. The high group did not split again until much later in this particular program run. The low group split next on previous major command and then on present organization level for a final R^2 of .082. Student's t-test, used to test the hypothesis that the means of the two groups were the same, rejected at the .000 level.

The group of people which placed a high relative weight on compliance with higher headquarters directives (mean = .209) was fairly small (N=56). This group was comprised of First Lieutenants and civilians with a GS-9 rating. The majority of the population placed a weight of .14 on compliance while about 20 percent (N=103) of the population placed an even lower relative weight on compliance (mean = .112). This low group is comprised of all grades

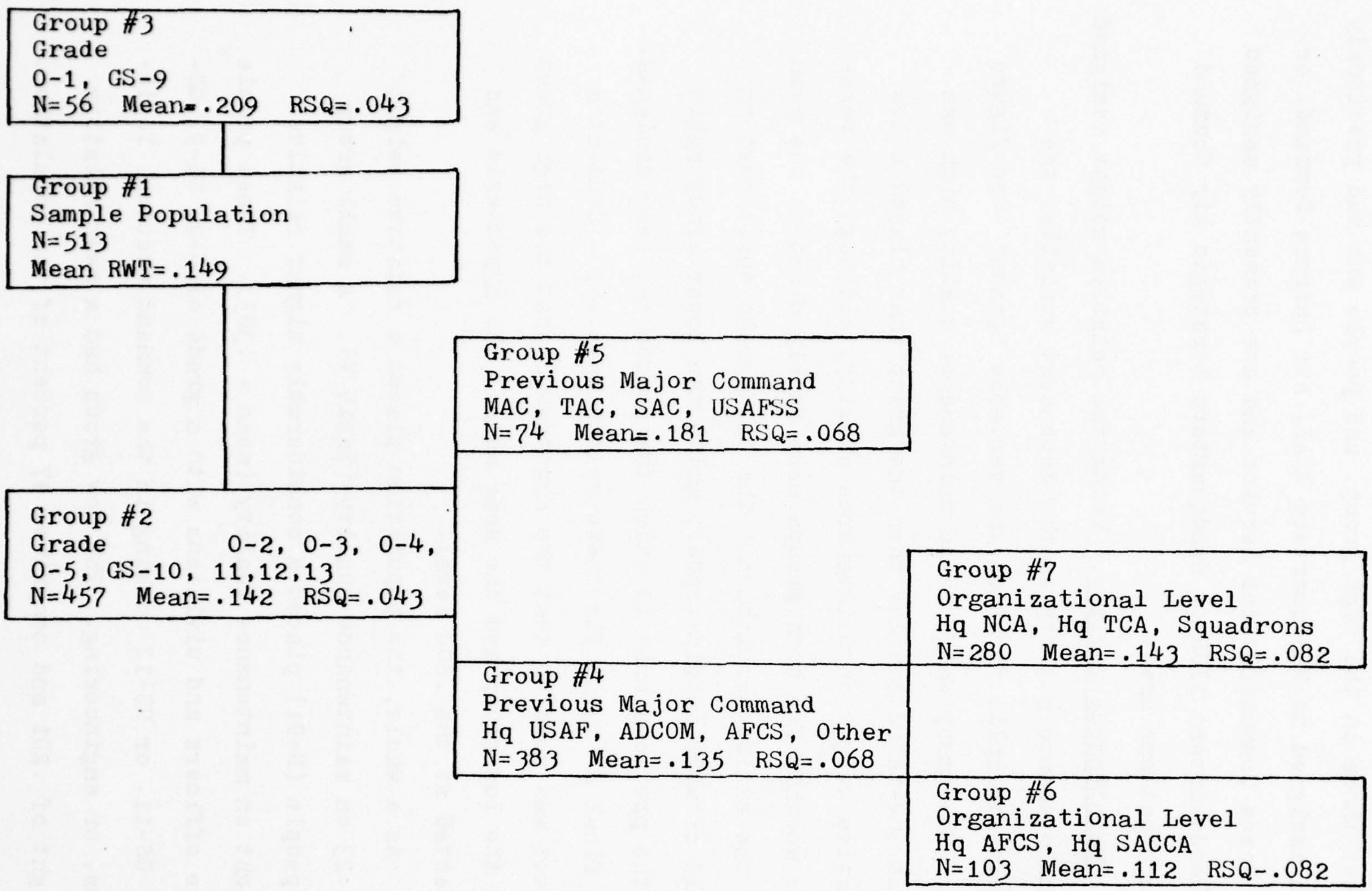

Figure 9. AID-TREE for Compliance

except those in the high group, and people who had previously been assigned to Headquarters USAF, Air Defense Command, or Air Force Communications Service and are presently assigned to Headquarters AFCS or Headquarters Strategic Air Command Communications Area.

Maintenance Quality. Using the relative weight assigned to maintenance quality as the dependent variable, the population split first on the variable "grade" (See Figure 10). The group which rated maintenance quality high was about one-third smaller than the group that placed a low relative weight on maintenance quality, although the relative weights for both groups were fairly close to the mean for the entire population. The high group split next on field of work (office code), while the lower group split on the previous unit to which the person had been assigned. The final R^2 value for these splits was .089. Student's *t*-test was used to test the hypothesis that the high group and the low group had the same mean. The hypothesis was rejected at the .000 level.

As a whole, the population placed a relative weight of .23 on maintenance quality (Table V). A small group of people (N=91) placed a considerably higher relative weight on maintenance quality (mean = .305). These people were officers and civilians with a grade of O-2, GS-9, GS-10, GS-11, or GS-12 working in the command section, logistics, or engineering. The low group had a mean relative weight of .201 and comprised 47 percent of the population.

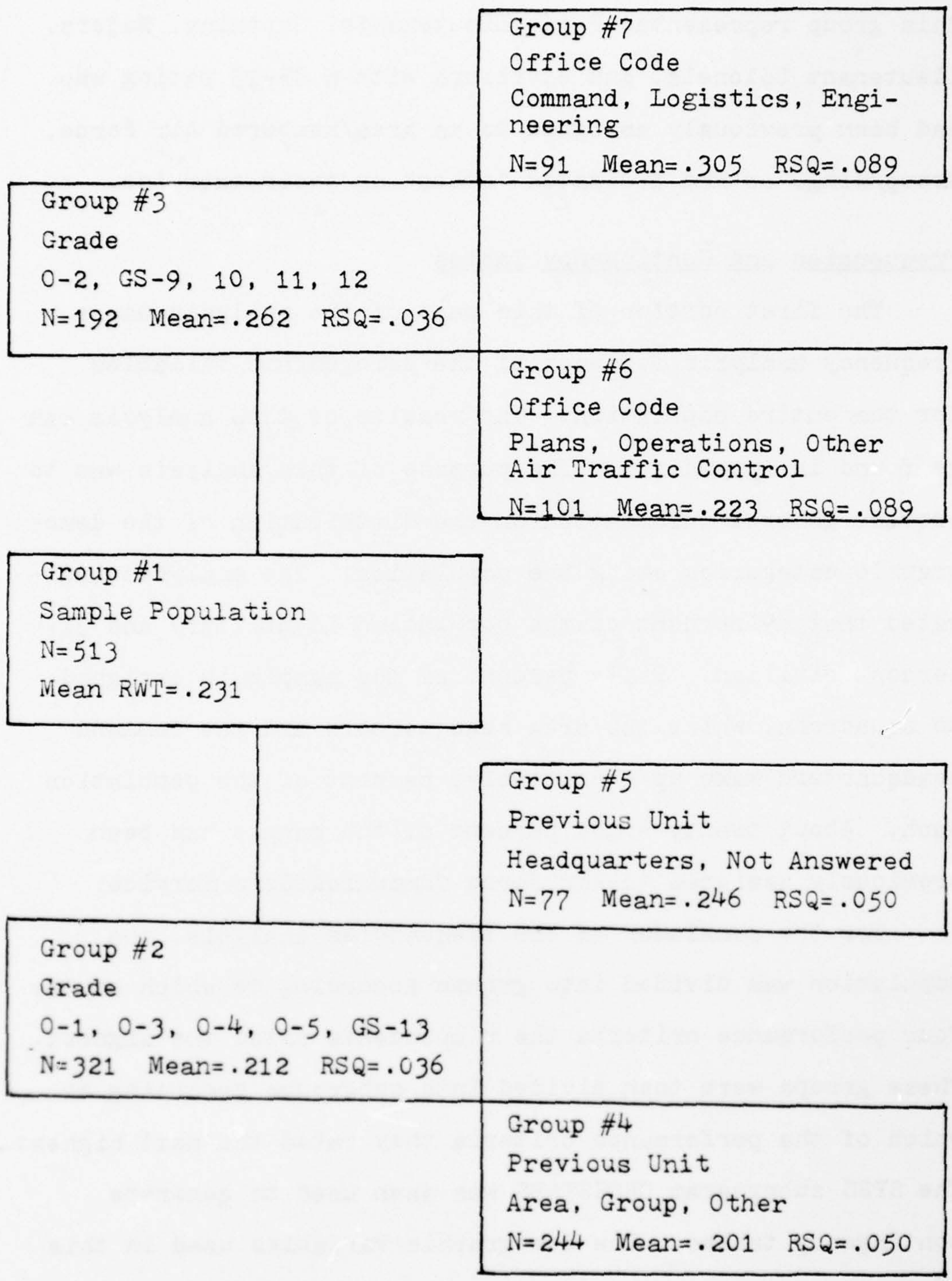

Figure 10. AID-TREE for Maintenance Quality

This group represented First Lieutenants, Captains, Majors, Lieutenant Colonels, and civilians with a GS-13 rating who had been previously assigned to an area/numbered Air Force, Group/Wing, or had indicated "other" on their exercise.

Frequencies and Contingency Tables

The first portion of this part of the analysis was a frequency analysis for each of the demographic variables for the entire population. The results of this analysis can be found in Appendix B. The purpose of this analysis was to provide general information on the distribution of the demographic categories among the population. The analysis indicated that 69 percent of the population is military and 31 percent civilian. Fifty percent of the sample is assigned to squadrons, while the area headquarters and the command headquarters make up about twelve percent of the population each. About twenty-eight percent of the sample had been previously assigned to Air Force Communications Service.

For the remainder of the frequencies analysis, the population was divided into groups according to which of the four performance criteria the respondents rated the highest. These groups were then divided into subgroups according to which of the performance criteria they rated the next highest. The SPSS subprogram CROSSTABS was then used to generate contingency tables. The demographic variables used in this analysis were those which appeared to be most important in the AID analysis. These were status, grade, organizational level, previous major command, and office code. An r x 2

table was constructed for each demographic variable. The rows represented the categories of the variable and the columns represented the portion of the population which gave the highest relative weight to a particular performance criterion and the portion which did not. The Chi-square statistic was used to test the hypothesis that the demographic composition of the population is independent of whether or not they gave the highest relative weight to a particular performance criterion. One problem which was encountered was that the cell frequencies in some of the contingency tables were too low (less than 5) to use the Chi-square statistic.

The first division of the population into groups indicated that the majority of the population placed service quality first. The next most important performance criterion was maintenance quality (See Table VI). For the remainder of the discussion, each performance criterion will be considered separately.

Table VI
Performance Criterion Rated First

Criterion	Number	Percent
Service Quality	335	65.3%
Maintenance Quality	52	10.1%
Personnel Programs	25	4.9%
Compliance	13	2.5%

<u>Service Quality</u>. As shown in Table VI, the vast majority of people placed a higher relative weight on service quality. The contingency table analysis indicated that

there is a relation between status and putting a high relative weight on service quality, as shown in Table VII. It appears that military tend to rate service quality high, while civilians tend to place it other than first. In addition, no relation was found to exist between organizational level and service rating (See Table VIII). The contingency tables for the other variables did not satisfy the cell frequency requirements.

Table VII
Contingency Table: Status by Service Rating

Count Col Pct	Service First	 Other	Row Total
Military	251 74.9	105 59.0	356
Civilian	84 25.1	73 41.0	157
Column Total	335 65.3	178 34.7	513 100.

Chi-square = 13.16 Deg. of Freedom = 1 α = .0003

The group of people which assigned the highest relative weight to service quality was further broken down as shown in Table IX. Of the 355 people who rated service first, 153, or 47 percent, rated maintenance quality second in importance.

<u>Maintenance Quality</u>. People who rated maintenance quality first composed the second largest group. Fifty-two (10.1 percent) of the 513 were in this group (Table VI). The contingency table analysis indicated that there was a

Table VIII
Contingency Table: Organizational Level by Service Rating

Count Col Pct	Service First	 Other	Row Total
AFCS	46 13.7	25 14.0	71
NCA	35 10.4	27 15.2	62
SACCA	48 14.3	20 11.2	68
TCA	38 11.3	20 11.2	58
Squadrons	168 50.1	86 48.3	254
Column Total	335 65.3	178 34.7	513 100.

Chi-square = 3.07 Deg. of Freedom = 4 α = .55

Table IX
Service Rated First

Criterion Rated Second	Number	Percent
Maintenance (M)	153	47%
Personnel Programs (PP)	58	17%
Compliance (C)	39	12%
M=PP (in importance)	25	7%
M=C	28	8%
C=PP	18	5%
PP=M=C	14	4%
	335	100%

relation between status and maintenance rating as shown in Table X. It appears that the civilians place a higher importance on maintenance quality than do the military.

The breakdown of the population by the performance criterion which they placed second in importance is shown in Table XI. The majority of the people placed service quality second in importance to maintenance quality.

Table X
Contingency Table: Status by Maintenance Rating

Count Col Pct	Maintenance First	 Other	Row Total
Military	25 48.1	331 71.8	356
Civilian	27 51.9	130 28.2	157
Column Total	52 10.1	461 89.9	513 100.

Chi-square = 11.3 Deg. of Freedom = 1 α = .008

Table XI
Maintenance Quality Rated First

Criterion Rated Second	Number	Percent
Personnel Programs (PP)	2	3.8%
Service (S)	23	44.2%
Compliance (C)	7	13.5%
PP=S (in importance)	6	11.5%
S=C	6	11.6%
PP=C	3	5.7%
PP=S=C	5	9.7%
	52	100%

Personnel Programs. Personnel programs was given a higher relative weight than the other performance criteria by 25 (4.9 percent) of the 513 respondents (Table VI). Due to the limited number of people in the category, only one contingency table was useable. Table XII indicates that there is basically no relation between status and the rating of personnel programs first.

Table XII
Contingency Table: Status by Personnel Programs Rating

Count / Col Pct	Personnel Programs: First	Personnel Programs: Other	Row Total
Military	13 52.0	343 70.3	356
Civilian	12 48.0	145 29.7	157
Column Total	25 4.9	488 95.1	513 100.

Chi-square = 2.9 Deg. of Freedom = 1 α = .08

As is shown in Table XIII, of the people who rated personnel programs first, 14 or 56 percent rated service quality second in importance. Maintenance quality was rated second by no one but tied with service quality in four cases.

Compliance. Compliance with higher headquarters directives was rated most important by only 13 people, or 2.5 percent of the population. As with personnel programs, the contingency table analysis was hampered by small cell frequencies. Table XIV, however, does indicate quite strongly that

Table XIII
Personnel Programs Rated First

Criterion Rated Second	Number	Percent
Service (S)	14	56%
Compliance (C)	4	16%
Maintenance (M)	0	0%
S=C (in importance)	1	4%
S=M	4	16%
C=M=S	2	8%
	25	100%

Table XIV
Contingency Table: Status by Compliance Rating

Count Col Pct	Compliance First	 Other	Row Total
Military	7 53.8	349 69.8	356
Civilian	6 46.2	151 30.2	157
Column Total	13 2.5	500 97.5	513 100.

Chi-square = .86 Deg. of Freedom = 1 α = .35

there is no relation between status and the rating of compliance first.

When the people who rated compliance were divided according to the performance criterion which they rated second, five people rated maintenance quality as second in importance as shown in Table XV.

Table XV
Compliance Rated First

Criterion Rated Second	Number	Percent
Personnel Programs (PP)	3	23%
Service (S)	2	15.4%
Maintenance (M)	5	38.5%
PP=M (in importance)	1	7.5%
PP=S=M	2	15.4%
	13	100%

V. SUMMARY AND CONCLUSIONS

Summary

The objectives of this study were to determine the extent to which the expectations of the organization and the expectations of small groups influence the decision-making behavior of middle managers assigned to Air Force Communications Service. It was assumed that certain demographic variables could be used to define various role groups. The variables used in this study were status, grade, organizational level, the number of months the respondent had been assigned to his present organization, office symbol, Professional Military Education history, previous major command, education level, and education field.

Methodology. The methodology of the study centered on a technique known as policy-capturing. The respondents were presented with sixteen hypothetical communications squadrons and were asked to rate each squadron on the basis of satisfactory or unsatisfactory ratings on four criteria. The four criteria were personnel programs, service quality, compliance with higher headquarters directives, and maintenance quality.

The data analysis was done in two parts. The first part consisted of the use of the Automatic Interaction Detector algorithm (AID) to determine the effect of the demographic variables on the respondents' decisions. In addition, AID was used to determine which role-groups rated each performance criterion high and which groups rated

each criterion low. The measure of magnitude used was the relative weight each respondent assigned to each performance criterion. The SPSS programs FREQUENCIES and CROSSTABS were then used to study the demographic distribution of the population according to which of the performance criteria were given the highest relative weight.

Results. The results of the first AID analysis indicated that roles as described by the demographic variables used in this study had very little effect on the decision-making behavior of the managers. These variables reduced the fraction of unexplained variance in the decisions of the population by only .008.

For the remainder of the analysis, each performance criterion was considered separately. The dependent variable in each of the analyses was the relative weight assigned to each of the performance criteria. In the AID analysis for each criterion, the demographic variables were not very powerful in explaining the variance in the relative weight assigned to that criterion, although the population was divided into several statistically significant groups.

The majority of the population indicated that service quality was the most important performance criterion. Maintenance quality was indicated as being second in importance with personnel programs and compliance with higher headquarters directives in third and fourth place.

Of the demographic information used in this study, five variables showed up as being slightly more important

than the others. These were: status, grade, organizational level, previous major command, and field of work. For the most part, the categories of these variables grouped differently each time they were used. Although grade did not split into military and civilian grades, it tended to split in that direction. The contingency table analyses tended to indicate a difference between the military and civilian populations. For organizational level, the individual squadrons tended to be separate from the rest of the population. Other global groupings were difficult to identify, although it was interesting to note that First Lieutenants and civilians with a GS-9 rating placed a significantly higher relative weight on compliance with higher headquarters directives than did the rest of the population.

Conclusions

The results of this study seem to indicate that several role-groups are active influences within the population. These groups have been identified as being related to grade, organizational level, previous major command, field of work, and whether the individual is military or civilian. In a practical sense, however, these role-groups have little influence on the decision-making behavior of the managers, thus implying that the organizational expectations or goals have more influence on the decision-making behavior than do the role-groups.

Suggestions for Further Research. This study focused on the influence of informal groups and the influence of

organizational goals on the decision-making behavior of middle managers. It was not possible to investigate all possible sources of role influence, therefore, this could be an area for further research. In addition, the organizational goals used in this study were operational goals, that is, the goals which are actually being pursued by the organization. Further studies could be done to investigate the influence of the stated or official goals of Air Force Communications Service on both the operational goals and the decision-making behavior of the managers.

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APPENDICES

APPENDIX A

Research Instrument

This appendix contains a portion of the decision analysis exercise including the introduction, the demographic questions, instructions, and an example decision task. This is followed by Table XVI which describes the experimental design.

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE COMMUNICATIONS SERVICE
RICHARDS-GEBAUR AIR FORCE BASE, MISSOURI 64030

REPLY TO ATTN OF: CS

3 MAR 1977

SUBJECT: Decision Making Analysis

TO:

1. The attached exercise is designed to investigate certain aspects of the decision-making behavior of AFCS managers. Request your participation in the exercise by rating the performance of sixteen hypothetical Type I communications squadrons based upon whether each unit is rated satisfactory or unsatisfactory with respect to four different performance criteria. The data gathered will be analyzed statistically and summarized in a thesis to be prepared by Air Force officers studying at the Air Force Institute of Technology. This project is being performed under the sponsorship of HQ AFCS and has full command support.

2. You will not be identified with the data in the final report and your individual responses in this exercise will not be made known to anyone except the officers conducting the study at AFIT. If you wish, an analysis of your decision-making performance will be provided to you at a later date. If you would like to receive this analysis, so indicate on page 3 of this booklet. The analysis will be sent directly to you by the AFIT students conducting the study.

3. Please follow the instructions for this exercise carefully. Your support can help to increase our understanding of AFCS decision dynamics and may aid in finding areas for improvement in management of the command. If you received this booklet by mail, use the enclosed self-addressed envelop to return it promptly to AFIT/ENS. Thank you for your cooperation.

FOR THE COMMANDER

RICHARD W. [illegible]
Chief of Staff

1 Atch
Decision Analysis Exercise

Providing the Reins of Command

DECISION ANALYSIS EXERCISE

SPRING 1977

AIR FORCE COMMUNICATIONS SERVICE

NOTICE

This booklet will be returned directly to AFIT/ENS. All personal data will be removed from the exercise and a numeric identifier will be attached to each booklet returned. No personal data will be forwarded to AFCS, nor will any such data be included in the research report. Collection of the above data is necessary to validate the authenticity of the exercise results and to aid in statistical analysis. No permanent record of personal data will be retained after the analysis is completed.

BIOGRAPHICAL DATA

Please circle or write in the appropriate response.

1. Are you a military officer or a civilian?

   A. Military officer
   B. Civilian

2. Please indicate your grade.

A. 0-1	F. GS-9
B. 0-2	G. GS-10
C. 0-3	H. GS-11
D. 0-4	I. GS-12
E. 0-5	J. GS-13

3. Military officers please indicate your date of rank. (Indicate year/month, e.g.: March 1974 = 7403)

   ____

4. What is your present unit?

   A. Hq AFCS
   B. NCA
   C. SACCA
   D. SCA
   E. TCA
   F. Group/Squadron, (Indicate unit number, e.g.: 2046, 1898)

   ____

5. What is your office symbol?

   ____

6. What year/month were you assigned to your present unit? (Indicate as above, e.g.: October 1975 = 7510)

   ____

7. Have you attended a resident PME course other than SOS or the Communications-Electronics Staff School?

   A. Yes
   B. No

8. Have you attended the Communications-Electronics Staff School?

   A. Yes
   B. No

9. What was your previous assignment?

   A. MAJCOM
      (1) USAF/JCS/DOD
      (2) ADCOM
      (3) AFCS
      (4) MAC
      (5) SAC
      (6) TAC
      (7) USAFSS
      (8) Other __________

   B. Unit Level
      (1) Hq
      (2) Area/NAF
      (3) Group/Sq
      (4) Other ______

10. What is your highest level of education?

   A. Less than a bachelor's degree
   B. Bachelor's degree
   C. Graduate work beyond a bachelor degree.
   D. Master's degree
   E. Postgraduate work beyond a master's degree
   F. Doctorate degree

11. What was/is your most recent major field of study?

   A. Engineering
   B. Science/mathematics
   C. Management
   D. Other

12. Do you wish to receive an analysis of your performance on this exercise?

   A. Yes
   B. No

13. If you indicated "Yes" in question 12, please print your name here.

   ____

INSTRUCTIONS

In this exercise you are requested to rate the performance of sixteen hypothetical AFCS Type I communications squadrons. The performance criteria upon which you will base your evaluation of each squadron consist of the following:

1. Personnel Programs. Indicates the success of the unit in terms of morale and welfare programs, disciplinary rate, IG complaint rate, retention rate, etc.

2. Quality of Service. Indicates unit success in factors related to the service provided to the customer. Includes such factors as speed of service, message handling time, operator courtesy, accuracy, air traffic control quality, and responsiveness to new customer requirements.

3. Compliance. Indicates how closely the unit being rated follows Air Force, AFCS, and Area directives, as determined by IG reports, Air Traffic Control Analysis reports, and staff visit reports.

4. Maintenance Quality. Indicates maintenance effectiveness and efficiency as reflected by maintenance analysis reports, operational ready rates, uptime rates, etc.

These four performance criteria are to be viewed as independent of one another. A rating of satisfactory or unsatisfactory for any single criterion is not related to, and does not influence, the ratings of the other criteria. You are to use only the information provided for each squadron to rate the overall performance of that unit as one of the following:

1. Highly Satisfactory. Minor deficiencies may exist. Some minor corrective action may be required.

2. Satisfactory. A few significant deficiencies may exist. Some monitoring by the Area staff might be indicated in certain areas.

3. Unsatisfactory. Some major deficiencies exist. Limited on-site Area staff assistance may be required. The replacement of at least one key unit manager might be considered.

4. Highly Unsatisfactory. Many major deficiencies exist. Immediate corrective action and extensive on-site Area staff assistance are required. Replacement of at least one key unit manager is recommended.

Refer to the example on the following page. You may refer back to previously completed evaluations at any time, but do not change any that have already been completed. You may remove this page for easy reference during the exercise if you wish.

EXAMPLE

Performance Evaluation of Squadron Number X

S=Satisfactory U=Unsatisfactory

1. Personnel programs in this squadron are rated. . . . S

2. The quality of service provided by this squadron is rated . . . . S

3. Compliance with AF/AFCS/Area directives in this squadron is rated as . . . . S

4. The quality of maintenance in this squadron is considered to be . . . . S

The overall performance of this AFCS squadron should be evaluated as:

Highly Unsatisfactory		Unsatisfactory		Satisfactory		Highly Satisfactory	
							X

Table XVI
Experimental Design

Task	Decision Criterion			
Squadron Number	Personnel Programs	Service Quality	Compliance	Maintenance Quality
1	S	U	U	U
2	U	S	S	S
3	S	U	U	S
4	U	S	S	U
5	S	S	S	S
6	S	S	U	U
7	U	U	U	S
8	S	S	S	U
9	U	S	U	S
10	S	U	S	U
11	U	U	S	S
12	U	U	U	U
13	S	U	S	S
14	U	U	S	U
15	S	S	U	S
16	U	S	U	U

APPENDIX B

Supplemental Data

This appendix includes supplemental data which was not included in the text. Included here are a more complete version of the AID run presented in Figure 6, the SPSS T-TEST results, the demographic distribution of the population as a whole, and the frequency tables not presented in Chapter IV.

```
*GROUP   1          MEAN=       3.94
* N=  6488          S.D.=       1.78
         LEVEL 1

*GROUP   3          MEAN=       5.03 RSQ =  .375*
* N=  3243          S.D.=       1.49 PROB= 0.000*
* PREDICTOR  9 SERVICE QUAL     P2
* CODES  1

*GROUP   2          MEAN=       2.85 RSQ =  .375*
* N=  3243          S.D.=       1.32 PROB= 0.000*
* PREDICTOR  9 SERVICE QUAL     P2
* CODES  0

*GROUP   5          MEAN=       5.85 RSQ =  .480*
* N=  1624          S.D.=       1.36 PROB= 0.000*
* PREDICTOR 11 MAINT QUALITY   P4
* CODES  1

*GROUP   4          MEAN=       4.22 RSQ =  .480*
* N=  1621          S.D.=       1.13 PROB= 0.000*
* PREDICTOR 11 MAINT QUALITY   P4
* CODES  0

*GROUP   7          MEAN=       3.52 RSQ =  .551*
* N=  1520          S.D.=       1.21 PROB= 0.000*
* PREDICTOR 11 MAINT QUALITY   P4
* CODES  1

*GROUP   6          MEAN=       2.17 RSQ =  .551*
* N=  1623          S.D.=       1.06 PROB= 0.000*
* PREDICTOR 11 MAINT QUALITY   P4
* CODES  0

*GROUP   9          MEAN=       6.63 RSQ =  .539*
* N=   812          S.D.=       1.27 PROB= 0.000*
* PREDICTOR  8 PERSONNEL PROG P1
* CODES  1

*GROUP   8          MEAN=       5.07 RSQ =  .599*
* N=   812          S.D.=        .94 PROB= 0.000*
* PREDICTOR  8 PERSONNEL PROG P1
* CODES  0

*GROUP  13          MEAN=       4.75 RSQ =  .646*
* N=   811          S.D.=        .95 PROB= 0.000*
* PREDICTOR  8 PERSONNEL PROG P1
* CODES  1

*GROUP  12          MEAN=       3.68 RSQ =  .646*
* N=   810          S.D.=       1.03 PROB= 0.000*
* PREDICTOR  8 PERSONNEL PROG P1
* CODES  0

*GROUP  11          MEAN=       4.09 RSQ =  .624*
* N=   810          S.D.=       1.04 PROB= 0.000*
* PREDICTOR  8 PERSONNEL PROG P1
* CODES  1

*GROUP  10          MEAN=       2.96 RSQ =  .624*
* N=   810          S.D.=       1.10 PROB= 0.000*
* PREDICTOR  8 PERSONNEL PROG P1
* CODES  0

*GROUP  15          MEAN=       2.72 RSQ =  .670*
* N=   811          S.D.=       1.02 PROB= 0.000*
* PREDICTOR 10 COMPLIANCE       P3
* CODES  1

*GROUP  14          MEAN=       1.63 RSQ =  .670*
* N=   812          S.D.=        .78 PROB= 0.000*
* PREDICTOR 10 COMPLIANCE       P3
* CODES  0
```

Figure 11. Initial AID-TREE

```
GROUP 17*FINAL MEAN=      7.64 RSQ =  .710
N=    406      S.D.=       .68 PROB= 0.000
PREDICTOR 10 COMPLIANCE      P3
CODES 1

GROUP  9        MEAN=      6.63
N=   812        S.D.=      1.27
        LEVEL 2

GROUP 47*FINAL MEAN=       5.90 RSQ =  .783
N=     71      S.D.=        .86 PROB=  .002
PREDICTOR  3 HEADQUARTERS LEVEL
CODES  1

GROUP 16        MEAN=      5.62 RSQ =  .710
N=   406        S.D.=       .85 PROB= 0.000
PREDICTOR 10 COMPLIANCE      P3
CODES  0

GROUP 46*FINAL MEAN=       5.56 RSQ =  .783
N=    335      S.D.=        .84 PROB=  .002
PREDICTOR  3 HEADQUARTERS LEVEL
CODES  5  6  2  3
```

Figure 11. (continued)

```
GROUP 37*FINAL MEAN=      3.88 RSQ =  .781
 N=   150       S.D.=      .95 PROB= 0.000
 PREDICTOR  2 GRADE
 CODES  9 10  1  2  8  6

GROUP 19        MEAN=      3.60 RSQ =  .726
 N=   405       S.D.=       .94 PROB= 0.000
 PREDICTOR 10 COMPLIANCE     P3
 CODES  1

GROUP 36*FINAL MEAN=      3.42 RSQ =  .781
 N=   246       S.D.=      .89 PROB= 0.000
 PREDICTOR  2 GRADE
 CODES  5  4  3

GROUP 10        MEAN=      2.96
 N=   810       S.D.=      1.10
        LEVEL 2

GROUP 45*FINAL MEAN=      2.66 RSQ =  .782
 N=    94       S.D.=      .88 PROB= 0.000
 PREDICTOR  2 GRADE
 CODES 10  9  8  6

GROUP 18        MEAN=      2.31 RSQ =  .726
 N=   404       S.D.=       .86 PROB= 0.000
 PREDICTOR 10 COMPLIANCE     P3
 CODES  0

GROUP 44*FINAL MEAN=      2.21 RSQ =  .782
 N=   310       S.D.=      .82 PROB= 0.000
 PREDICTOR  2 GRADE
 CODES  1  4  2  3  5
```

Figure 11. (continued)

```
GROUP 35*FINAL MEAN=      4.85 RSQ =  .780
 N=   150        S.D.=      1.03 PROB= 0.000
 PREDICTOR  2 GRADE
 CODES  2  9  1 10  8  6

GROUP  21       MEAN=      4.54 RSQ =  .734
 N=   406       S.D.=      1.02 PROB= 0.000
 PREDICTOR 10 COMPLIANCE        P3
 CODES  1

GROUP 34*FINAL MEAN=      4.33 RSQ =  .780
 N=   246        S.D.=       .96 PROB= 0.000
 PREDICTOR  2 GRADE
 CODES  5  4  3

GROUP  11       MEAN=      4.09
 N=   810       S.D.=      1.04
        LEVEL 2

GROUP 49*FINAL MEAN=      3.96 RSQ =  .784
 N=   137        S.D.=       .89 PROB= 0.000
 PREDICTOR  2 GRADE
 CODES  2  9 10  6  8

GROUP  20       MEAN=      3.64 RSQ =  .734
 N=   404       S.D.=       .85 PROB= 0.000
 PREDICTOR 10 COMPLIANCE        P3
 CODES  0

GROUP 48*FINAL MEAN=      3.48 RSQ =  .784
 N=   257        S.D.=       .78 PROB= 0.000
 PREDICTOR  2 GRADE
 CODES  5  4  1  3
```

Figure 11. (continued)

```
GROUP 12        MEAN=      3.68
N=   810        S.D.=      1.03
     LEVEL 2

GROUP 23        MEAN=      4.15 RSQ =  .743
N=   405        S.D.=       .80 PROB= 0.000
PREDICTOR 10 COMPLIANCE      P3
CODES  1

GROUP 61*FINAL MEAN=       4.17 RSQ =  .786
N=   383        S.D.=       .80 PROB=  .003
PREDICTOR  6 EDUCATION LEVEL
CODES  4  1  3  2

GROUP 50*FINAL MEAN=       3.64 RSQ =  .786
N=    22        S.D.=       .57 PROB=  .003
PREDICTOR  5 EDUCATION LEVEL
CODES  6  5

GROUP 22        MEAN=      3.21 RSQ =  .743
N=   405        S.D.=      1.03 PROB= 0.000
PREDICTOR 10 COMPLIANCE      P3
CODES  0

GROUP 33        MEAN=      3.27 RSQ =  .779
N=   339        S.D.=      1.02 PROB=  .004
PREDICTOR  2 GRADE
CODES  8  5  9  4  6 10  3

GROUP 39        MEAN=      3.29 RSQ =  .781
N=   282        S.D.=      1.04 PROB=  .205
PREDICTOR  3 HEADQUARTERS LEVEL
CODES  6  1  3  5

GROUP 38*FINAL MEAN=       3.14 RSQ =  .781
N=    57        S.D.=       .93 PROB=  .205
PREDICTOR  3 HEADQUARTERS LEVEL
CODES  2

GROUP 32*FINAL MEAN=       2.94 RSQ =  .779
N=    66        S.D.=      1.01 PROB=  .004
PREDICTOR  2 GRADE
CODES  1  2
```

Figure 11. (continued)

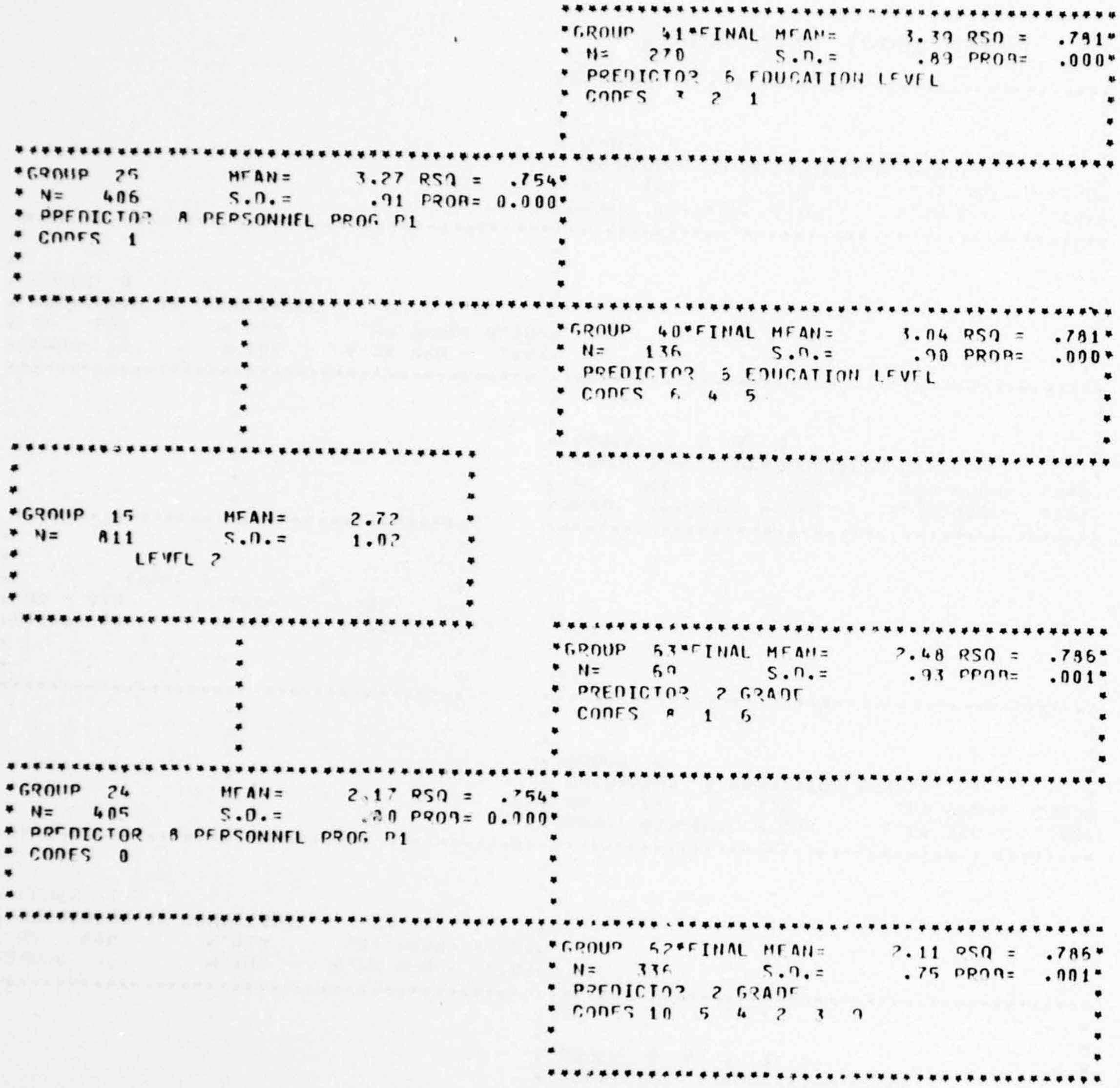

Figure 11. (continued)

```
GROUP 13         MEAN=      4.75
 N=   811        S.D.=       .95
        LEVEL 2

    GROUP 27         MEAN=      5.22 RSQ =  .763
     N=   406        S.D.=       .81 PROB= 0.000
     PREDICTOR 10 COMPLIANCE       P3
     CODES  1

        GROUP  59 FINAL MEAN=       5.25 RSQ =  .786
         N=   386        S.D.=       .80 PROB=  .002
         PREDICTOR  5 EDUCATION LEVEL
         CODES  6  4  2  1  3

        GROUP  58 FINAL MEAN=       4.65 RSQ =  .786
         N=    20        S.D.=       .65 PROB=  .002
         PREDICTOR  5 EDUCATION LEVEL
         CODES  5

    GROUP 26         MEAN=      4.28 RSQ =  .763
     N=   405        S.D.=       .85 PROB= 0.000
     PREDICTOR 10 COMPLIANCE       P3
     CODES  0

        GROUP  51 FINAL MEAN=       4.35 RSQ =  .784
         N=   251        S.D.=       .80 PROB=  .040
         PREDICTOR  3 HEADQUARTERS LEVEL
         CODES  2  5  1  3

        GROUP  50 FINAL MEAN=       4.18 RSQ =  .784
         N=   154        S.D.=       .91 PROB=  .040
         PREDICTOR  3 HEADQUARTERS LEVEL
         CODES  6
```

Figure 11. (continued)

```
                                             GROUP  53 FINAL MEAN=     5.84 RSQ =  .784
                                              N=   44       S.D.=       .88 PROB=  .005
                                              PREDICTOR  2 GRADE
                                              CODES  6  1 10

GROUP  29        MEAN=      5.50 RSQ =  .771
 N=   406        S.D.=       .84 PROB= 0.000
 PREDICTOR 10 COMPLIANCE      P3
 CODES  1
                                             GROUP  52 FINAL MEAN=     5.46 RSQ =  .784
                                              N=   352      S.D.=       .82 PROB=  .005
                                              PREDICTOR  2 GRADE
                                              CODES  2  5  3  4  9  8

GROUP   8        MEAN=      5.07
 N=   812        S.D.=       .94
        LEVEL 2

                                             GROUP  55 FINAL MEAN=     4.76 RSQ =  .784
                                              N=   173      S.D.=       .73 PROB=  .007
                                              PREDICTOR  7 EDUCATION FIELD
                                              CODES  0  3

GROUP  28        MEAN=      4.63 RSQ =  .771
 N=   406        S.D.=       .82 PROB= 0.000
 PREDICTOR 10 COMPLIANCE      P3
 CODES  0
                                             GROUP  54 FINAL MEAN=     4.54 RSQ =  .784
                                              N=   233      S.D.=       .86 PROB=  .007
                                              PREDICTOR  7 EDUCATION FIELD
                                              CODES  4  1  2
```

Figure 11. (continued)

```
                                                  *GROUP  57*FINAL MEAN=     2.49 RSQ =  .785*
                                                  * N=    94       S.D.=      .96 PROB= 0.000*
                                                  * PREDICTOR  2 GRADE
                                                  * CODES 10  8  9  6
*GROUP  31       MEAN=     2.07 RSQ =  .778*
* N=   406       S.D.=      .81 PROB= 0.000*
* PREDICTOR  9 PERSONNEL PROG P1
* CODES  1
                                                  *GROUP  56*FINAL MEAN=     1.95 RSQ =  .785*
                                                  * N=   312       S.D.=      .72 PROB= 0.000*
                                                  * PREDICTOR  2 GRADE
                                                  * CODES  4  1  3  2  5

*GROUP  14       MEAN=     1.63
* N=   812       S.D.=      .78
       LEVEL 2

*GROUP  30*FINAL MEAN=     1.18 RSQ =  .778*
* N=   406       S.D.=      .40 PROB= 0.000*
* PREDICTOR  8 PERSONNEL PROG P1
* CODES  0
```

Figure 11. (continued)

```
*GROUP  43*FINAL MEAN=      3.33 RSQ =  .782*
* N=   213        S.D.=     1.02 PROB=  .226*
* PREDICTOR  2 GRADE
* CODES  4  3  8

                    *
                    *
                    *
*GROUP  39         MEAN=      3.29
* N=   282         S.D.=      1.04
         LEVEL 3
                    *
                    *
                    *
*GROUP  42*FINAL MEAN=      3.19 RSQ =  .782*
* N=    69        S.D.=     1.08 PROB=  .226*
* PREDICTOR  2 GRADE
* CODES  9  5 10  6
```

Figure 11. (continued)

TABLE XVII
t-Test Results

Personnel Programs

	NUMBER OF CASES	MEAN	STANDARD DEVIATION	STANDARD ERROR	POOLED VARIANCE ESTIMATE T VALUE	POOLED VARIANCE ESTIMATE DEGREES OF FREEDOM	POOLED VARIANCE ESTIMATE 2-TAIL PROB.
High RWT	54	.2160	.142	.019	5.32	235	.000
Low RWT	183	.1288	.093	.007			

Service Quality

	NUMBER OF CASES	MEAN	STANDARD DEVIATION	STANDARD ERROR	POOLED VARIANCE ESTIMATE T VALUE	POOLED VARIANCE ESTIMATE DEGREES OF FREEDOM	POOLED VARIANCE ESTIMATE 2-TAIL PROB.
High RWT	28	.5719	.153	.029	6.08	58	.000
Low RWT	32	.3327	.151	.027			

TABLE XVII (continued)

Maintenance Quality

	NUMBER OF CASES	MEAN	STANDARD DEVIATION	STANDARD ERROR	POOLED VARIANCE ESTIMATE T VALUE	DEGREES OF FREEDOM	2-TAIL PROB.
High RWT	91	.3058	.143	.015	6.09	179	.000
Low RWT	90	.1894	.112	.012			

Compliance with Higher Headquarters' Directives

	NUMBER OF CASES	MEAN	STANDARD DEVIATION	STANDARD ERROR	POOLED VARIANCE ESTIMATE T VALUE	DEGREES OF FREEDOM	2-TAIL PROB.
High RWT	26	.2251	.038	.013	5.99	119	.000
Low RWT	95	.1101	.083	.009			

TABLE XVIII
Distribution of the Demographic Variables

Status

	CODE	ABSOLUTE FREQUENCY	RELATIVE FREQUENCY (PERCENT)	ADJUSTED FREQUENCY (PERCENT)	CUMULATIVE ADJ FREQ (PERCENT)
Military	1	356	69.4	69.4	69.4
Civilian	2	157	30.6	30.6	100.0
	TOTAL	513	100.0	100.0	

Grade

	CODE	ABSOLUTE FREQUENCY	RELATIVE FREQUENCY (PERCENT)	ADJUSTED FREQUENCY (PERCENT)	CUMULATIVE ADJ FREQ (PERCENT)
2/Lt	1	29	5.7	5.7	5.7
1/Lt	2	54	10.5	10.5	16.2
Captain	3	148	28.8	28.8	45.0
Major	4	87	17.0	17.0	62.0
Lt. Col.	5	38	7.4	7.4	69.4
GS-9	6	27	5.3	5.3	74.7
GS-10	7	7	1.4	1.4	76.0
GS-11	8	64	12.5	12.5	88.5
GS-12	9	40	7.8	7.8	96.3
GS-13	10	19	3.7	3.7	100.0
	TOTAL	513	100.0	100.0	

TABLE XVIII (continued)

Organizational Level

	CODE	ABSOLUTE FREQUENCY	RELATIVE FREQUENCY (PERCENT)	ADJUSTED FREQUENCY (PERCENT)	CUMULATIVE ADJ FREQ (PERCENT)
Hq AFCS	1	71	13.8	13.8	13.8
Hq NCA	2	62	12.1	12.1	25.9
Hq SACCA	3	68	13.3	13.3	39.2
Hq TCA	5	58	11.3	11.3	50.5
Squadrons	6	254	49.5	49.5	100.0
	TOTAL	513	100.0	100.0	

Office Code

	CODE	ABSOLUTE FREQUENCY	RELATIVE FREQUENCY (PERCENT)	ADJUSTED FREQUENCY (PERCENT)	CUMULATIVE ADJ FREQ (PERCENT)
Command	1	38	7.4	7.4	7.4
Logistics	2	112	21.8	21.8	29.2
Plans	3	58	11.3	11.3	40.5
I. G.	4	5	1.0	1.0	41.5
Operations	5	86	16.8	16.8	58.3
Engineering	6	61	11.9	11.9	70.2
Air Traffic Control	7	72	14.0	14.0	84.2
Other	8	81	15.8	15.8	100.0
	TOTAL	513	100.0	100.0	

TABLE XVIII (continued)

Previous Major Command

	CODE	ABSOLUTE FREQUENCY	RELATIVE FREQUENCY (PERCENT)	ADJUSTED FREQUENCY (PERCENT)	CUMULATIVE ADJ FREQ (PERCENT)
Blank	0	57	11.1	11.1	11.1
Hq USAF	1	26	5.1	5.1	16.2
ADCOM	2	12	2.3	2.3	18.5
AFCS	3	144	28.1	28.1	46.6
MAC	4	9	1.8	1.8	48.3
SAC	5	61	11.9	11.9	60.2
TAC	6	13	2.5	2.5	62.8
USAFSS	7	2	.4	.4	63.2
Other	8	189	36.8	36.8	100.0
	TOTAL	513	100.0	100.0	

Previous Unit

	CODE	ABSOLUTE FREQUENCY	RELATIVE FREQUENCY (PERCENT)	ADJUSTED FREQUENCY (PERCENT)	CUMULATIVE ADJ FREQ (PERCENT)
Blank	0	68	13.3	13.3	13.3
Hqtrs	1	67	13.1	13.1	26.3
Area/ NAF	2	65	12.7	12.7	39.0
Group/ Sq	3	204	39.8	39.8	78.8
Other	4	109	21.2	21.2	100.0
	TOTAL	513	100.0	100.0	

AD-A045 985 AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OHIO SCH--ETC F/G 5/10
THE INFLUENCE OF ROLES ON THE DECISION-MAKING BEHAVIOR OF AIR F--ETC(U)
SEP 77 J P MILLER
UNCLASSIFIED AFIT/GSM/SM/77S-11 NL

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TABLE XVIII (continued)

Resident Professional Military Education

	CODE	ABSOLUTE FREQUENCY	RELATIVE FREQUENCY (PERCENT)	ADJUSTED FREQUENCY (PERCENT)	CUMULATIVE ADJ FREQ (PERCENT)
Blank	0	1	.2	.2	.2
Yes	1	104	20.3	20.3	20.5
No	2	408	79.5	79.5	100.0
	TOTAL	513	100.0	100.0	

Communications/Electronics Staff School

	CODE	ABSOLUTE FREQUENCY	RELATIVE FREQUENCY (PERCENT)	ADJUSTED FREQUENCY (PERCENT)	CUMULATIVE ADJ FREQ (PERCENT)
Blank	0	4	.8	.8	.8
Yes	1	44	8.6	8.6	9.4
No	2	465	90.6	90.6	100.0
	TOTAL	513	100.0	100.0	

Education Field

	CODE	ABSOLUTE FREQUENCY	RELATIVE FREQUENCY (PERCENT)	ADJUSTED FREQUENCY (PERCENT)	CUMULATIVE ADJ FREQ (PERCENT)
Blank	0	12	2.3	2.3	2.3
Engineering	1	75	14.6	14.6	17.0
Science	2	68	13.3	13.3	30.2
Management	3	198	38.6	38.6	68.8
Other	4	160	31.2	31.2	100.0
	TOTAL	513	100.0	100.0	

TABLE XVIII (continued)

Education Level

	CODE	ABSOLUTE FREQUENCY	RELATIVE FREQUENCY (PERCENT)	ADJUSTED FREQUENCY (PERCENT)	CUMULATIVE ADJ FREQ (PERCENT)
Blank	0	2	.4	.4	.4
No Degree	1	137	26.7	26.7	27.1
Bachelor	2	134	26.1	26.1	53.2
Grad Work	3	96	18.7	18.7	71.9
Master's	4	122	23.8	23.8	95.7
Post Grad	5	20	3.9	3.9	99.6
Doctorate	6	2	.4	.4	100.0
	TOTAL	513	100.0	100.0	

APPENDIX C

Supplemental Information

This appendix contains the raw data format, some techniques used in transforming the data, and transformed data format. In addition, the letter from the Operations Research Analysis Office of Air Force Communications Service verifying the performance criteria selected for this study is included.

The raw data was transcribed from the exercise booklets onto IBM cards in the format as shown in Table XIX. The data was expanded from one card per record to 16 cards per record, that is, one decision per card. In addition, the values of the performance criteria were matched with each decision. A rating of satisfactory was given a value of "1" and a rating of unsatisfactory was given a value of "0."

The SPSS subprogram REGRESSION (Nie, et al., 1975: 320-367) was used in the step-wise mode to calculate the regression coefficients for each of the performance criteria. The independent variables were the values of the performance criteria for each decision, and the dependent variable was the evaluation given to that decision. Since the experimental design is orthogonal, the relative weights placed on each of the criteria for the population as a whole was calculated using a modification of Hoffman's formula for relative weight (Hoffman, 1960:121).

$$\text{Relative weight} = \frac{\beta^2_i}{R^2}$$

A FORTRAN program was written with the assistance of Major McNichols to do a variety of tasks (See Figure 12). First, using the least squares method, the program calculated the regression coefficients and then the relative weights placed on the performance criteria by each individual. Next, the program converted the alphanumeric characters in the data set to integer values by shifting the value within the data register. By subtracting 54 from an

Table XIX
Raw Data Format

Card Column	Item	Type of Character
1	Status	alpha
2	Grade	alpha
3,4	Date of Rank--Year	integer
4,5	Date of Rank--Month	integer
7	Organizational Level	integer
8-11	Unit Number	integer
12-14	Office Symbol	alpha
15,16	Year Assigned	integer
17,18	Month Assigned	integer
19	PME History	alpha
20	Comm/Elec Staff School	alpha
21	Previous Major Command	integer
22	Previous Unit Level	integer
23	Education Level	alpha
24	Education Field	alpha
25	Analysis Request	alpha
26-41	Decision Evaluations	integer
42	Unit Code	alpha
43,44	Book Number	integer
45-71	Name	alpha

alphanumeric character, the computer will read that character as an integer. The transformation key is A=1, B=2, C=3, etc. Next, the program calculated the number of months the person had been assigned to his present unit using the formula:

months = (77 - year assigned) x 12 + (6 - month assigned)

Finally, the program was used to group the various office symbols into eight categories of IF statements. The

transformed data format is shown in Table XX. The raw data set is on file at the Air Force Institute of Technology.

Table XX
Transformed Data Format

Column	Item
1,2	Status
3,4	Grade
5,6	Date of Rank--Year
7,8	Date of Rank--Month
9,10	Organizational Level
11-14	Unit Number
15,16	Office Symbol
17,18	Year Assigned
19,20	Month Assigned
21	Resident PME History
22	Comm/Elec Staff School
23	Previous Major Command
24	Previous Unit
25	Education Level
26	Education Field
27	Analysis Request
28	Unit Code
29-31	Months Assigned
32	Office Code
33-36	Personnel Programs RWT
37-40	Service Quality RWT
41-44	Compliance RWT
45-48	Maintenance Quality RWT
49-52	R^2 Value

Note: All values are integer except Analysis Request and Unit Code.

```
      PROGRAM DATATR (INPUT,OUTPUT,TAPE1,TAPE2)
      DIMENSION IDEM(16),COEF(4),XP(4,16),Y(16),ICOEF(4)
      N=0
      XPFAC=SQRT(4./15.)
  100 YS=YS2=0.
      DO 200 J=1,15
      READ (1,10) Y(J),(XP(I,J),I=1,4)
   10 FORMAT(T54,5F1.0)
      IF(EOF(1).NE.0)GO TO 700
      YS=YS+Y(J)
      YS2=YS2+Y(J)**2
  200 CONTINUE
      READ(1,11) (IDEM(I),I=1,16),Y(16),(XP(I,16),I=1,4)
   11 FORMAT(2A1,I4,A1,I4,A2,T15,2I2,2A1,2I1,4A1,T54,5F1.0)
      YS=YS+Y(16)
      YS2=YS2+Y(16)**2
      YMEAN=YS/16.
      SSY=YS2-(YS**2)/16.
      SIGY=SQRT(SSY/15.)
      DO 300 I=1,4
  300 COEF(I)=0.
      DO 400 J=1,16
      DO 400 I=1,4
      COEF(I)=COEF(I)+((XP(I,J)-.5)/XPFAC)*((Y(J)-YMEAN)/SIGY)
  400 CONTINUE
      SSR=0.0
      DO 500 I=1,4
      COEF(I)=((1/15.)*COEF(I))**2
  500 SSR=SSR+COEF(I)
      DO 600 I=1,4
  600 COEF(I)=COEF(I)/SSR
      DO 625 I=1,4
  625 ICOEF(I)=IFIX(COEF(I)*1000)
```

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Figure 12. Computer Program for Data Transformation

```
      ISSR=SSR*1000
       MONTHS=(77-IDEM(7))*12 +(6-IDEM(8))
      IF(IDEM(6).EQ.2HCC.OR.IDEM(6).EQ.2HCE.OR.IDEM(6).EQ.2HCO.OR.IDEM(6
     +).EQ.2HCS)GO TO 641
      IF(IDEM(6).EQ.2HLG.OR.IDEM(6).EQ.2HNC)GO TO 642
      IF(IDEM(6).EQ.2HXR.OR.IDEM(6).EQ.2HPR.OR.IDEM(6).EQ.2HXO.OR.IDEM(6
     +).EQ.2HXP)GO TO 643
      IF(IDEM(6).EQ.2HII.OR.IDEM(6).EQ.2HIG)GO TO 644
      IF(IDEM(6).EQ.2HDD.OR.IDEM(6).EQ.2HBC.OR.IDEM(6).EQ.2HMB)GO TO 645
      IF(IDEM(6).EQ.2HEP.OR.IDEM(6).EQ.2HDE.OR.IDEM(6).EQ.2HSD)GO TO 646
      IF(IDEM(6).EQ.2HEF.OR.IDEM(6).EQ.2HEM.OR.IDEM(6).EQ.2HFP)GO TO 647
      IOFF=8
      GO TO 650
 641  IOFF=1
      GO TO 650
 642  IOFF=2
      GO TO 650
 643  IOFF=3
      GO TO 650
 644  IOFF =4
      GO TO 650
 645  IOFF=5
      GO TO 650
 646  IOFF=6

     GO TO 650
 647 IOFF=7
     GO TO 650
 650 CONTINUE
     IF(IDEM(1).EQ.1H )IDEM(1)=0
     IDEM(1)=SHIFT(IDEM(1),-54)
     IF(IDEM(2).EQ.1H )IDEM(2)=0
     IDEM(2)=SHIFT(IDEM(2),-54)
```

Figure 12. Computer Program for Data Transformation (continued)

```
      IF(IDEM(4).EQ.1H )IDEM(4)=0
      IDEM(4)=SHIFT(IDEM(4),-54)
      IF(IDEM(9).EQ.1H )IDEM(9)=0
      IDEM(9)=SHIFT(IDEM(9),-54)
      IF(IDEM(10).EQ.1H )IDEM(10)=0
      IDEM(10)=SHIFT(IDEM(10),-54)
      IF(IDEM(13).EQ.1H )IDEM(13)=0
      IDEM(13)=SHIFT(IDEM(13),-54)
      IF(IDEM(14).EQ.1H )IDEM(14)=0
      IDEM(14)=SHIFT(IDEM(14),-54)
      PRINT 20,(IDEM(I),I=1,16),MONTHS,IOFF,(ICOEF(I),I=1,4),ISSR
   20 FORMAT(1H,2I2,I4,I2,I4,A2,2I2,6I1,2A1,I3,I1,5I4)
      WRITE(2,21)   (IDEM(I),I=1,15),MONTHS,IOFF,(ICOEF(I),I=1,4),ISSR
   21 FORMAT(2I2,I4,I2,I4,A2,2I2,6I1,2A1,I3,I1,5I4)
      GO TO 100
  700 STOP
      END
```

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Figure 12. Computer Program for Data Transformation (continued)

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE COMMUNICATIONS SERVICE
RICHARDS-GEBAUR AIR FORCE BASE, MISSOURI 64030

REPLY TO ATTN OF: OA

11 Jan 1977

SUBJECT: Research Proposal

TO: Lt Col Carl G. O'Berry
4111 Silver Oak Street
Dayton, OH 45424

1. The research proposal shown in your letter of 1 Dec 1976 dealing with the goal congruence between AFCS Headquarters and the six Areas and between the Areas and the Operating Units has been reviewed, and the following comments are offered:

a. We agree in principle with the proposal; the four decision criteria (personnel, service quality, compliance and maintenance quality) appear realistic and independent. Moreover, they represent valid indicators which relate to the decision making policies associated with this Command.

b. The data collection method for the proposed research should be coordinated with AFCS prior to actual implementation. The anticipated requirements for AFCS resources must be defined prior to final approval.

2. Point of contact at this Headquarters is Mr. Thomas Yium, AUTOVON 465-3631, or (816) 348-3631.

THOMAS YIUM
Director
Operations Research Analysis Office

Figure 13. Letter from the Operations Research Analysis Office

VITA

Jacob Paul Miller was born on October 30. 1948 in Peoria, Illinois. He graduated from Richwoods Community High School, Peoria Heights, Illinois, in 1966 and from Saint Olaf College, Northfield, Minnesota, in 1970 with a Bachelor of Arts degree in Chemistry. He was a member of the Air Force Reserve Officers Training Corps while at Saint Olaf and was commissioned a Second Lieutenant on May 30, 1970. After receiving his aeronautical rating of Navigator from the 3935th Navigator Training Wing, Mather Air Force Base, California, he was assigned to the 54th Weather Reconnaissance Squadron, Anderson Air Force Base, Guam, in June of 1971 as a WC-130 navigator. In October 1972, Captain Miller was assigned to the 8th Military Airlift Wing, McChord Air Force Base, Washington, as a C-141 navigator. He then was assigned to the Air Force Institute of Technology, Wright-Patterson Air Force Base, Ohio, in June 1976 as a resident student in Graduate Systems Management.

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Roles
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Decision Analysis
AID

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The policy-capturing technique was used to capture the decision-making behavior of 500 Air Force Communications Service middle managers assigned to headquarters AFCS, Northern Communications Area, Strategic Air Command Communications Area, and Tactical Communications Area. Eleven pieces of demographic information were collected which were assumed to represent a variety of possible role behaviors. The AID algorithm, regression analysis, and contingency tables were used to determine the extent

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to which organizational goals and role-groups influence the decision-making behavior of middle managers. The results of the study indicate that several role-groups are active within the population. However, in a practical sense, the role-groups have little effect on decision-making, thus implying that the organizational goals have more effect on decision-making than do role-groups.